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ABSTRACT

The "Integrated Mathematics Project" was conducted under the sponsorship of the Montana Council of Teachers of Mathematics and designed to examine the issues of teaching secondary school mathematics in an integrated manner to all students. The purpose was to improve mathematics literacy in the general population in accordance with suggestions by both the 1987 Mathematical Sciences Education Board (MSEB) draft report, "A Framework for the Revision of the K-12 Mathematics Curriculum," and the 1989 National Council of Teachers of Mathematics publication (NCTM), "Curriculum and Evaluation Standards for School Mathematics." A questionnaire was developed to determine the extent of the interest in, as well as the curriculum structure and content of, the pedagogical strategies critical to an integrated secondary mathematics program and to its expected outcomes and implementation. Responses from 54% of state supervisors (n=27), 31% of district supervisors (n=140), 33% of mathematics teacher educators (n=164), and 28% of mathematics teachers (n=140) were compiled to develop a first report. The data analysis focused on the following areas of concern: (1) a definition of integrated mathematics; (2) extent of interest in integrated mathematics at the state, district, and teacher preparation levels, including expected objectives for students and teachers; and (3) implications of adopting such a program in secondary schools for professional organizations, colleges and universities, state departments of education, school systems, testing organizations, curriculum developers and publishers, and funding agencies. The rest of the report discusses each of three areas in turn. Appendices, forming about two-thirds of the document, include questionnaires used, national demographic data, survey results, and a packet of materials sent to participants who reviewed the second draft of the policy report. A separately bound executive summary accompanies the report. (MDH)

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INTEGRATED MATHEMATICS

Definitions
Issues
Implications

Executive Summary

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Montana Council of Teachers of Mathematics

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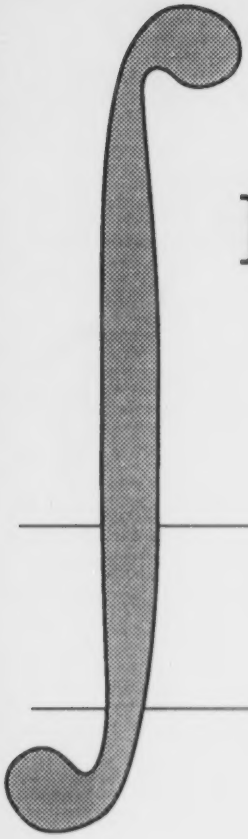

INTEGRATED MATHEMATICS

Definitions
Issues
Implications

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The Project Staff wishes to thank the Washington State Mathematics Council for its support, Steve Kinholt for his work on data input and preparation of charts and tables in this report, and Mark Roddy and Jim Trudnowski for their assistance at the August conference.

JAN 1990

The funding for the Integrated Mathematics Project was obtained through a grant to the Montana Council of Teachers of Mathematics from the Exxon Foundation.

INTRODUCTION

The Integrated Mathematics Project was designed to examine the issues of teaching secondary school mathematics in an integrated manner to all students in order to improve mathematics literacy in the general population. These are issues of national importance as indicated in the 1987 Mathematical Sciences Education Board (MSEB) draft report entitled A Framework for the Revision of the K-12 Mathematics Curriculum. The MSEB report states that "All years of both elementary and secondary school mathematics should be integrated in all grades in the sense that all the subject matter... should be interwoven and not considered as separate, unrelated topics." Further, it states "the mathematics studied should be fundamentally the same for all students."

The 1989 publication of the National Council of Teachers of Mathematics (NCTM), Curriculum and Evaluation Standards for School Mathematics, states, "One possible next step is for teachers and mathematics educators to develop curricula based on the Standards. For example, the secondary school mathematics curriculum has typically been separated into courses with a specific subject orientation (e.g., algebra, geometry, statistics). This sequence provides teachers and students with a single focus. We now challenge educators to integrate mathematics topics across courses so that students can view major mathematical ideas from more than one perspective and bring interrelated ideas to bear on new topics or problems."

"To promote an understanding of mathematics, students must relate topics rather than study them separately."

-- Survey Respondent

Thus, both the MSEB report and the NCTM Standards suggest that mathematics programs in secondary schools should be taught in an integrated manner to all students. In addition, interest in integrated mathematics programs is evidenced in New York where such a program has been demanded by the Regents Examination Curriculum for college-bound students for over twenty years; in the State of Washington which adopted mathematics curriculum guidelines in 1986 that promote an integrated mathematics program; and in the current mathematics curriculum

guidelines for Montana secondary schools.

As the above discussion indicates, there appears to be a movement toward an integrated mathematics program for secondary schools in the United States. This interest demands that mathematics educators do the following:

- *Develop a precise definition of integrated mathematics;*
- *Determine the extent of interest in integrated mathematics at the state, district, and teacher preparation levels;*
- *Determine the implications for students, teachers, curriculum, and teacher preparation, if such a program is adopted.*

PROJECT PLAN

In order to ascertain the extent of interest in, and the implications of, adopting an integrated mathematics program and to develop a policy report regarding its implementation, a consortium of mathematics educators from Montana and Washington requested and received a grant from the Exxon Foundation to conduct a national survey on these issues. The project was developed by Dan Dolan, Mathematics Supervisor for the Office of Public Instruction in Montana, Johnny W. Lott, Department of Mathematical Sciences, University of Montana, Jack Beal and John P. Smith, College of Education, University of Washington. It was conducted under the sponsorship of the Montana Council of Teachers of Mathematics (MCTM) with assistance from the Washington State Mathematics Council (WSMC) and the State Departments of Education in Montana and Washington.

A questionnaire was developed in the Fall of 1988 and distributed nationally in March 1989 to determine the extent of the interest in, the curriculum structure and the content of, the pedagogical strategies critical to, and expected outcomes and implementation of, an integrated secondary mathematics program. The survey included all 50 state mathematics supervisors, and a national random sample

of 500 mathematics supervisors, 500 mathematics teacher educators, and 500 secondary mathematics teachers. Results from 27 (54%) state supervisors, 140 (31%) district supervisors, 164 (33%) mathematics teacher educators, and 140 (28%) mathematics teachers were compiled in order to develop a first draft report.

Project staff met in June, 1989, to draft the first version of the report. The draft was then sent to 19 mathematics leaders from Oregon, Montana and Washington. This group consisted of six college and university professors of mathematics or mathematics education, ten secondary mathematics teachers, a state mathematics curriculum coordinator, a mathematician from industry, and one graduate student in mathematics education. Also included were the presidents and past presidents of MCTM and WSMC. These leaders met in August, 1989, to review and refine the draft and to provide additional input into the development of the final report. The project staff met at the conclusion of the August meeting and again in October and November, 1989, to write the following final report.

"Students should learn that mathematics is not an assortment of segmented topics, but rather a system operating as a whole, with many tools available for use in problem solving situations."

-- Survey Respondent

SUPPORT FOR AN INTEGRATED MATHEMATICS PROGRAM

There is very strong support, from all groups, for movement to an integrated secondary mathematics program to meet the needs of all students. State and district supervisors indicate that this will take place within the next five years.

DEFINITION OF AN INTEGRATED MATHEMATICS PROGRAM

An integrated mathematics program for all students is a holistic mathematical curriculum which:

- *consists of topics chosen from a wide variety of mathematical fields and blends those topics to emphasize the connections and unity among those fields;*
- *emphasizes the relationships among topics within mathematics as well as between mathematics and other disciplines;*
- *each year, includes those topics at levels appropriate to students' abilities;*
- *is problem centered and application based;*
- *emphasizes problem-solving and mathematical reasoning;*
- *provides multiple contexts for students to learn mathematical concepts;*
- *provides continual reinforcement of concepts through successively expanding treatments of those concepts;*
- *makes use of appropriate technology.*

EXPECTED OUTCOMES

Students:

- *Students from all ability levels will take more mathematics with the greatest increase among those of average ability.*

- *Students will find mathematics more interesting, will have a greater understanding of mathematics, and will have less loss of skills over time.*

- *Students will be better prepared in mathematics with the greatest expectation for improvement in the noncollege-bound group.*

- *Student achievement scores on current standardized tests will not be adversely affected.*

Teachers:

- *There will be greater communication among teachers using an integrated mathematics program than those using a traditional program.*

- *Teachers will think of themselves as mathematics teachers rather than algebra or geometry teachers.*

- *Teachers will teach topics from a broader range of mathematical fields using multiple contexts.*

IMPLICATIONS

Professional Organizations

- *The National Council of Teachers of Mathematics, its affiliates, and other professional organizations must assume leadership in promoting and facilitating integrated mathematics programs.*

The publications, meetings, and inservice programs of professional mathematics organizations must endorse and promote integrated mathematics.

Colleges and Universities

- *College entrance requirements should be modified to accommodate an integrated mathematics program in secondary schools.*

Many institutions specify a requirement of Algebra I, Geometry, and Algebra II for college admissions. This specification of course titles could preclude the implementation of integrated mathematics programs in some states.

- *Colleges and universities must change existing entry-level courses to build upon the background of students who have taken integrated mathematics.*

Many institutions have college algebra, trigonometry, and pre-calculus as entry-level classes. To build upon the background of students who have taken integrated mathematics, these traditional courses should change to reflect an integrated approach.

- *Mathematics and mathematics education programs must emphasize an integrated view of mathematics and a variety of instructional methods including the use of technology.*

Traditionally, college and university mathematics courses are taught in

isolation without viewing mathematics as a whole. Lecture is the general method of presentation. It is well documented that teachers teach as they have been taught. Therefore, preparing teachers to teach an integrated mathematics program demands some coursework in integrated mathematics and a variety of methods of instruction including strategies for connecting topics and utilizing technology.

State Departments of Education

- *State course guidelines must accommodate an integrated mathematics program.*

Specific course titles are included in syllabi for mathematics courses at the secondary level in some states. The implementation of an integrated mathematics program demands that specific titles should not be a part of the state guidelines.

- *State graduation requirements must accommodate an integrated mathematics program.*

In some states, graduation requirements for high schools include specific course titles. In order for an integrated mathematics program to be implemented in those states, these requirements must be changed.

- *State teacher certification standards must change to ensure that teachers are prepared to teach an integrated mathematics program.*

Many states demand specific mathematics and pedagogy courses as part of the teacher certification program. In order for an integrated mathematics program to be implemented in those states, the certification requirements must be reviewed and possibly changed to ensure that certified teachers are adequately prepared for teaching integrated mathematics programs.

- *State school accreditation standards must be changed to ensure that mathematics classrooms are staffed by certified mathematics teachers.*

Staffing mathematics classes with teachers adequately trained in the mathematics necessary to implement a quality integrated mathematics program will be a major problem for schools. Consequently, school accreditation standards should be modified to ensure that all mathematics teachers at the secondary level have at least a minor in mathematics. Accreditation standards for schools should also reflect the requirement for continuous staff development in mathematics for those persons teaching mathematics.

School Systems

- *All school-related officials must become familiar with such national reform documents as the MSEB Everybody Counts and the NCTM Curriculum and Evaluation Standards for School Mathematics.*

- *All school-related officials must make the financial commitment necessary to implement and maintain an integrated mathematics program.*

Implementation of an integrated mathematics program necessitates a financial commitment from school districts for continued inservice, purchase of appropriate technologies, and possibly restructuring classroom environments in order to provide teachers with adequate materials and supplies to maintain such a program.

- *More teachers, prepared in mathematics and mathematics education, will be needed to teach integrated mathematics programs.*

As integrated mathematics programs attract more students to study mathematics, secondary schools will need more teachers prepared in mathematics and mathematics education for the additional classes. If state certification allows teachers with minimal preparation to teach courses up to and including Algebra I, then they would probably not be prepared to teach in an integrated program, even at the ninth-grade level. Minimal preparation may not include topics from probability, statistics, and discrete mathematics which are woven into an integrated program.

- *Continuing inservice for mathematics teachers must be provided to prepare them to teach in an integrated mathematics program.*

The implementation of an integrated mathematics program necessitates continuous inservice of current mathematics teachers to prepare them to teach such a program. Even those who are currently certified may be neither prepared to teach the blended sequence of topics with the different methods of presentation nor to utilize new technologies which are required for this teaching.

- *Policy makers, administrators and teachers must utilize available state and federal funds for providing inservice training for mathematics teachers.*

All school policy makers, administrators, and teachers should be aware of local and state funding that may be available for the implementation of an integrated mathematics program and the staff development necessary for teachers. All school personnel must become knowledgeable about the funding available from the Dwight D. Eisenhower Mathematics and Science Education Improvement Program which provides state departments of education, institutions of higher education, and local districts with specific dollars for staff development in the area of mathematics.

- *Students transferring between an integrated mathematics program and a traditional program may experience no more problems than those transferring among other mathematics programs.*

Problems of transfer between an integrated mathematics program and a traditional program may be no more significant than ordinary student transfer problems, such as, different textbooks, different teaching styles, and different requirements of a school or an instructor. The problems incurred by a student transferring between a traditional and an integrated program may involve some background missed prior to the transfer.

Testing Organizations

- *An integrated mathematics program demands a shift in emphasis on test construction to focus on concepts, skills and applications characteristic of an integrated approach.*

- *All tests must be designed to accommodate the use of technology.*

An integrated mathematics program focuses on problem-centered learning, problem solving, the use of technology, and different approaches to mathematics. Current testing on procedures and skills must be replaced by open-ended questions, use of calculators and computers and a greater problem-solving focus.

Curriculum Developers and Publishers

- *Appropriate curriculum materials for an integrated mathematics program must be developed to meet the needs of all students.*

Curricular materials necessary to meet the needs of all students taking an integrated mathematics program are not currently available. Immediate steps must be taken by curriculum developers and publishers to develop these materials. Once materials are produced, publishers should be involved in, and supportive of, on-going inservice to assist teachers in successfully implementing integrated programs.

Funding Agencies

- *Governmental and private funding agencies must make integrated mathematics programs a priority focus of their funding programs.*

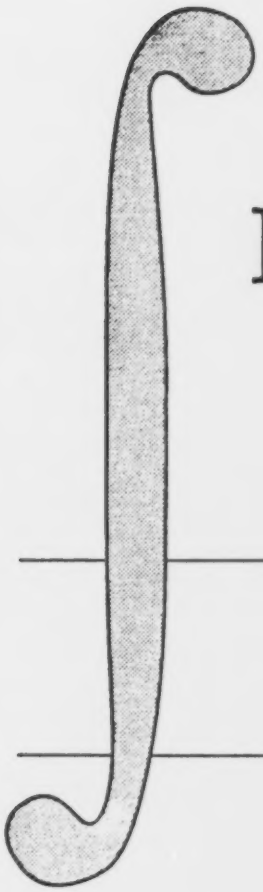
Because of the documented move to integrated mathematics programs, governmental and private funding agencies should fund projects which include curriculum and staff development at the secondary and collegiate levels, program and student assessment, and other research involving these programs. Agencies must encourage projects which include cooperative efforts among curriculum developers, publishers, and professional organizations.

Shared Responsibility Among All Groups

- *Integrated mathematics materials for all students must be developed.*

- *Inservice leaders must be prepared to facilitate the implementation of integrated mathematics programs.*

- *There is a need for research on all aspects regarding an integrated mathematics program.*



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Montana Council of Teachers of Mathematics

INTEGRATED MATHEMATICS

DEFINITION

ISSUES

IMPLICATIONS

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ACKNOWLEDGEMENTS

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The funding for the Integrated Mathematics Project was obtained through a grant to the Montana Council of Teachers of Mathematics from the Exxon Foundation and with the assistance of the Washington State Mathematics Council.

GENERAL INTRODUCTION

The Integrated Mathematics Project was designed to examine the issues of teaching secondary school mathematics in an integrated manner to all students in order to improve mathematics literacy in the general population. These are issues of national importance as indicated in the 1987 Mathematical Sciences Education Board (MSEB) draft report entitled A Framework for the Revision of the K-12 Mathematics Curriculum. The MSEB report states that "All years of both elementary and secondary school mathematics should be integrated in all grades in the sense that all the subject matter... should be interwoven and not considered as separate, unrelated topics." Further, it states "the mathematics studied should be fundamentally the same for all students."

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Thus, both the MSEB report and the NCTM Standards suggest that mathematics programs in secondary schools should be taught in an integrated manner to all students. In addition, interest in integrated mathematics programs is evidenced in New York where such a program has been demanded by the Regents Examination Curriculum for college bound students for over twenty years; in the State of

Washington which adopted mathematics curriculum guidelines in 1986 that promote an integrated mathematics program; and in the current mathematics curriculum guidelines for Montana secondary schools.

As the above discussion indicates, there appears to be a movement toward an integrated mathematics program for secondary schools in the United States. This interest demands that mathematics educators do the following:

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- *Determine the implications for students, teachers, curriculum, and teacher preparation if such a program is adopted.*

PROJECT PLAN

In order to ascertain the extent of interest in, and the implications of, adopting an integrated mathematics program and to develop a policy report regarding the implementation of such programs, a consortium of mathematics educators from Montana and Washington requested and received a grant from the Exxon Foundation for such a project. The project was developed by Dan Dolan, Mathematics Supervisor for the state of Montana, Johnny W. Lott, Department of Mathematical Sciences, University of Montana, Jack Beal and John P. Smith, College of Education, University of Washington, hereafter referred to as the investigators. The project was conducted under the sponsorship of the Montana Council of Teachers of Mathematics (MCTM) with assistance from the Washington State Mathematics Council (WSMC) and the Departments of Education from Montana and Washington.

The project plan follows:

(1) *In October, 1988,* the investigators completed a preliminary draft of a questionnaire for use in a national survey regarding the implementation of an integrated mathematics program.

(2) *In November, 1988,* the investigators completed the final draft of the survey questionnaire.

(3) *From December, 1988, to January, 1989,* the survey questionnaire was pilot tested in Montana, Washington, and Nevada.

(4) *In February, 1989,* the survey instrument was finalized and printed.

(5) *In March and April, 1989,* the survey was distributed to a random sample of secondary mathematics teachers, college and university mathematics educators, mathematics department chairs/supervisors, and to all state

mathematics supervisors. The completed instruments were returned to the University of Washington.

(6) *In May, 1989,* the survey results were compiled by staff at the University of Washington.

(7) *In June, 1989,* the investigators met to analyze the results and to draft a policy statement including a revised definition of integrated mathematics, a statement of interest in integrated mathematics, outcomes, and implications of implementing such a program. In addition, the investigators planned for an August meeting of a panel to review the policy statement.

(8) *In July, 1989,* invitations, an agenda for the August meeting, and a draft of the policy statement were mailed to potential members of the review panel.

(9) *In August, 1989,* a review panel, consisting of 19 mathematics education leaders from Montana, Oregon, and Washington, met to study the results of the survey and the policy statement. The panel provided additional input to the investigators to assist in developing the final policy report.

(10) *In October and November, 1989,* the investigators met to review the results of the August meeting and to develop the final policy report.

(11) *In December, 1989,* the investigators finalized a policy report on the implementation of an integrated mathematics program for secondary schools.

(11) *In January, 1990,* the final report was printed and distributed nationally.

NATIONWIDE SURVEY

Development of Questionnaires

Four questionnaires were developed to survey state supervisors, mathematics department chairs/supervisors, secondary mathematics teachers, and college and university mathematics educators, hereafter referred to as teacher educators. Each survey included a demographic section and five lettered parts. Part A gave the respondents a working definition of "integrated mathematics" and asked for responses about components of an integrated mathematics program based upon the working definition. This definition was designed to contrast integrated mathematics with traditional mathematics instruction but not to make it so specific as to narrowly define integrated mathematics thereby limiting the range of responses. Part B asked for responses regarding teachers in an integrated mathematics program. Part C asked respondents to identify outcomes expected from implementation of an integrated mathematics program. Part D asked respondents to identify inhibitors to the implementation of an integrated mathematics program. Part E was designed to ascertain the current usage of integrated mathematics programs, the level of support for such programs, the availability of curricular materials for such programs, and differences, if any, in respondents' definitions of integrated mathematics and the working definition. Parts A-C of the questionnaires were common for all groups. The questions about demographic data and Parts D and E were designed for each of the specific groups.

The content of the questions was based on a thorough analysis of the literature in mathematics education and the collective experience of the investigators related to integrated mathematics instruction. The questions and response modes used reflected the need for reducing ambiguity and increasing the reliability of responses. The length of the questionnaires was designed to obtain the most information possible with the greatest rate of return using the fewest number of questions.

Drafts and Trials

The questionnaires were revised several times by the investigators before being pilot tested with secondary mathematics teachers and department chairs/supervisors in two school districts in the state of Washington, one district in Nevada, two state supervisors, and three teacher educators. The responses and comments of the pilot groups were analyzed to determine the need for further modification of the draft questionnaires. The modifications were incorporated into the final questionnaires as seen in Appendix A.

Respondent Selection

In 1989, the National Council of Teachers of Mathematics had a mailing list of 33,560 mathematics teachers, 1136 supervisors, and 2600 teacher educators available. Five hundred names were randomly selected from each of these three membership groups from the NCTM mailing list. All fifty state supervisors received a questionnaire bringing the total number of questionnaire recipients to 1550. There was no follow-up of non-respondents since anonymity was maintained for all who returned the questionnaire.

Results

Of the total of 1550 questionnaires mailed, 471 (30%) were returned. By category the number of respondents were: state supervisors 27 (54%), department chairs/district supervisor* 140 (31%), mathematics teachers 140 (28%), and teacher

* The five hundred department chair/supervisor names included nine from the states of Washington and Montana. These nine names were deleted from the sample; however, they were included in the statewide survey of all mathematics department chairs/supervisors in Washington and Montana. The percentage of returns reflects the revised sample of 491 mailed questionnaires.

educators 164 (33%). Table 1 gives a summary of responses by state. Demographic information for teachers, supervisors, and teacher educators may be found in Appendix B.

The results of the national surveys were compiled into six data sets. The first set of results represents a summary of all responses to sections common to all four surveys, i.e., Parts A, B, and C as found in Figure 1. The second set of results, C-1, is a summary of all state supervisor responses, the third set, C-2, is a summary of all department chairs/district supervisors, the fourth set, C-3, summarizes all responses from mathematics teachers, and, the fifth set, C-4, summarizes all responses from teacher educators. For data sets C-1 through C-4, the histograms showing the responses for that group for each question are superimposed on the composite results of all groups as represented by the box and broken line configuration, respectively. Finally, all written comments are summarized in C-5. The results, C-1 through C-5, may be seen in Appendix C.

Table 2 is a summary of the results from Part E. It shows the status of integrated mathematics in secondary schools as reported by the four groups.

The department/chair supervisor questionnaire was also mailed to all department chairs/supervisors in Montana and Washington. One hundred seventy questionnaires were mailed to Montana and 67 (39%) were returned. Five hundred twelve questionnaires were mailed to Washington supervisors, and 129 (25%) were returned. An analysis of the questionnaires from the two states indicates general agreement among department chairs/supervisors with their counterparts nationally except in Part B, statements 1, 2, and 3. The average for both states on these three items was significantly lower than the national average. These statements were: (1) "Use different teaching methods than those currently used"; (2) "Have a different mathematics major than currently offered"; and (3) "Have a different preparation in pedagogy than currently offered". The results of the surveys from Montana and Washington may be found in Appendix D-1 and D-2.

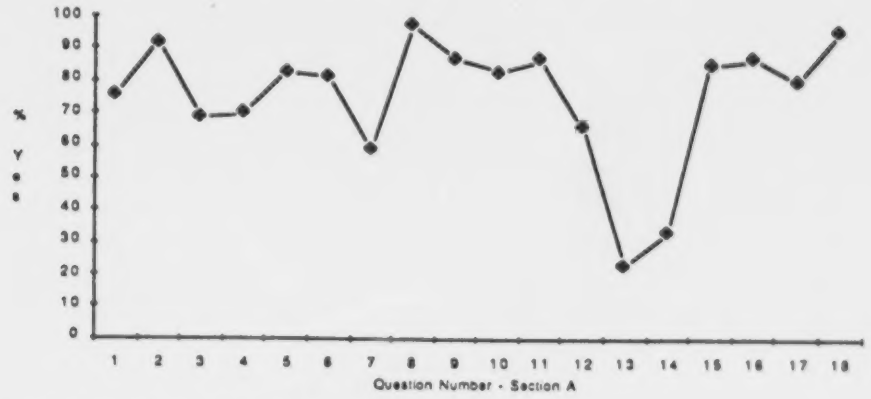
Table I
Summary of State Returns

STATE	State Supvr. N = 25	Dept. Chair Dist. Supvr N = 140	Mathematics Teachers N = 140	Teacher Educators N = 157
Alabama (AL)	4 % / 1	1 % / 1	1 % / 1	1 % / 1
Alaska (AK)	0 % / 0	1 % / 1	0 % / 0	0 % / 0
Arizona (AZ)	0 % / 0	1 % / 2	1 % / 1	2 % / 3
Arkansas (AR)	4 % / 1	1 % / 2	0 % / 0	2 % / 3
California (CA)	4 % / 1	4 % / 6	8 % / 11	9 % / 14
Colorado (CO)	0 % / 0	1 % / 1	1 % / 1	2 % / 3
Connecticut (CT)	4 % / 1	3 % / 4	4 % / 6	3 % / 4
Deleware (DE)	4 % / 1	1 % / 1	0 % / 0	0 % / 0
Dist. of Columbia (DC)	4 % / 1	1 % / 1	0 % / 0	0 % / 0
Florida (FL)	0 % / 0	5 % / 7	4 % / 6	3 % / 5
Georgia (GA)	0 % / 0	3 % / 5	4 % / 5	1 % / 2
Hawaii (HI)	4 % / 1	0 % / 0	0 % / 0	0 % / 0
Idaho (ID)	0 % / 0	0 % / 0	0 % / 0	1 % / 2
Illinois (IL)	4 % / 1	3 % / 5	9 % / 13	4 % / 6
Indiana (IN)	4 % / 1	0 % / 0	3 % / 4	2 % / 3
Iowa (IA)	0 % / 0	2 % / 3	1 % / 1	2 % / 3
Kansas (KS)	0 % / 0	1 % / 2	1 % / 1	1 % / 2
Kentucky (KY)	0 % / 0	1 % / 1	0 % / 0	3 % / 4
Louisiana (LA)	0 % / 0	2 % / 3	1 % / 2	0 % / 0
Maine (ME)	0 % / 0	0 % / 0	1 % / 1	1 % / 1
Maryland (MD)	0 % / 0	1 % / 2	2 % / 3	3 % / 4
Massachusetts (MA)	0 % / 0	4 % / 6	3 % / 4	1 % / 2
Michigan (MI)	4 % / 1	0 % / 0	4 % / 6	2 % / 3
Minnesota (MN)	4 % / 1	0 % / 0	2 % / 3	3 % / 5
Mississippi (MS)	0 % / 0	0 % / 0	0 % / 0	0 % / 0
Missouri (MO)	0 % / 0	1 % / 2	2 % / 3	3 % / 5
Montana (MT)	4 % / 1	* N/A	1 % / 1	2 % / 3
Nebraska (NE)	4 % / 1	0 % / 0	1 % / 1	4 % / 6
Nevada (NV)	4 % / 1	1 % / 1	1 % / 1	0 % / 0
New Hampshire (NH)	4 % / 1	1 % / 1	1 % / 2	1 % / 1
New Jersey (NJ)	4 % / 1	4 % / 6	4 % / 5	1 % / 2
New Mexico (NM)	0 % / 0	1 % / 1	1 % / 1	1 % / 2
New York (NY)	4 % / 1	8 % / 12	6 % / 9	5 % / 8
North Carolina (NC)	0 % / 0	3 % / 4	2 % / 3	3 % / 4
North Dakota (ND)	0 % / 0	1 % / 1	0 % / 0	3 % / 4
Ohio (OH)	0 % / 0	2 % / 3	6 % / 9	3 % / 5
Oklahoma (OK)	0 % / 0	0 % / 0	0 % / 0	1 % / 2
Oregon (OR)	4 % / 1	2 % / 3	0 % / 0	1 % / 2
Pennsylvania (PA)	4 % / 1	7 % / 10	6 % / 8	5 % / 7
Rhode Island (RI)	0 % / 0	0 % / 0	0 % / 0	1 % / 1
South Carolina (SC)	0 % / 0	3 % / 4	0 % / 0	1 % / 2
South Dakota (SD)	0 % / 0	0 % / 0	1 % / 1	1 % / 1
Tennessee (TN)	4 % / 1	2 % / 3	2 % / 3	3 % / 4
Texas (TX)	0 % / 0	4 % / 6	5 % / 7	5 % / 7
Utah (UT)	4 % / 1	1 % / 1	0 % / 0	1 % / 2
Vermont (VT)	0 % / 0	1 % / 2	1 % / 1	1 % / 1
Virginia (VA)	4 % / 1	1 % / 1	5 % / 7	3 % / 4
Washington (WA)	0 % / 0	* N/A	1 % / 2	1 % / 2
West Virgina (WV)	0 % / 0	3 % / 4	0 % / 0	0 % / 0
Wisconsin (WI)	4 % / 1	4 % / 6	3 % / 4	4 % / 6
Wyoming (WY)	0 % / 0	1 % / 2	0 % / 0	0 % / 0
Not Given	8 % / 2	10 % / 14	2 % / 3	4 % / 6

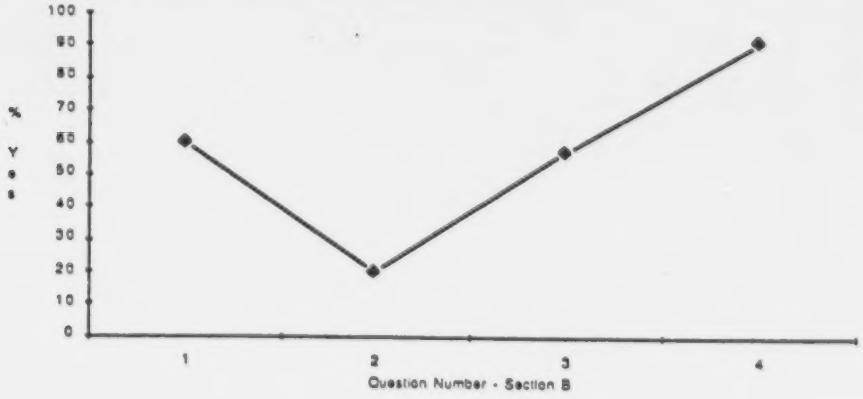
* NOTE: all Montana and Washington supervisors were surveyed. Results were summarized separately.

Figure 1
All Respondents
Responses by Item

PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program



PART C: Outcomes of an Integrated Program

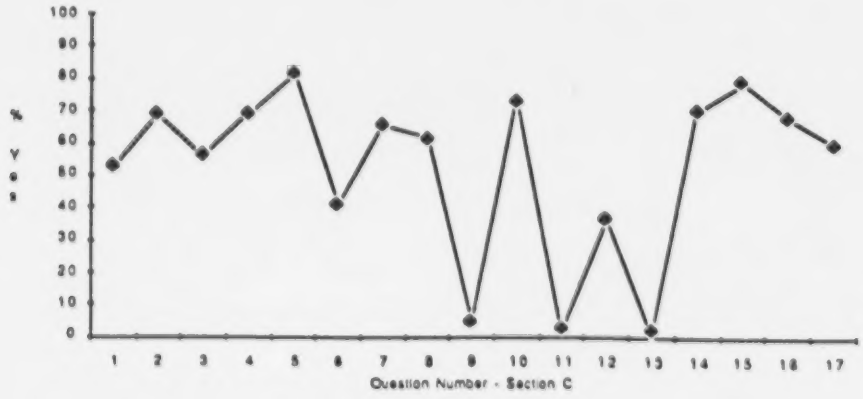


Table II
Summary of Part E Data

	State Supvr. N = 25	Dept. Chair Dist. Supvr N = 140	Mathematics Teachers N = 140	Teacher Educators N = 157
Do you have Integrated Mathematics Programs?				
Yes	53 % / 13	31 % / 44	24 % / 33	N/A
No	48 % / 12	66 % / 92	73 % /104	N/A
Blank	0 % / 0	3 % / 4	2 % / 3	N/A
If yes, what% of all student participate?	11 % (avg)	N/A	N/A	N/A
If yes, which students are in the program?				
College-bound	N/A	47 % / 14	24 % / 8	N/A
Noncollege-bound	N/A	13 % / 4	24 % / 8	N/A
All students	N/A	40 % / 12	51 % / 17	N/A
If yes, what percent take integrated math for:				
One year	N/A	58 % (avg)	N/A	N/A
Two years	N/A	56 % (avg)	N/A	N/A
Three years	N/A	57 % (avg)	N/A	N/A
If yes, what textbook series is used?				
Merrill	N/A	21 % / 10	11 % / 4	N/A
Houghton-Mifflin	N/A	26 % / 12	19 % / 7	N/A
Addison-Wesley	N/A	4 % / 2	5 % / 2	N/A
Amsco	N/A	26 % / 12	24 % / 9	N/A
Other	N/A	23 % / 11	41 % / 15	N/A
(Some indicated more than one text)				
If no, do you anticipate a future program?				
Yes	37 % / 6	25 % / 26	18 % / 20	N/A
No	48 % / 12	28 % / 29	35 % / 39	N/A
Don't Know	0 % / 0	46 % / 47	47 % / 52	N/A
If yes, in the next				
1-3 Years	71 % / 18	33 % / 9	50 % / 10	N/A
3-5 Years	29 % / 7	33 % / 9	25 % / 5	N/A
> 5 Years	0 % / 0	33 % / 9	25 % / 5	N/A
If yes, what % of all students participate?	26 % (avg)	N/A	N/A	N/A
If yes, which students will be in the program?				
College-bound	N/A	18 % / 5	25 % / 5	N/A
Non-college bound	N/A	14 % / 4	25 % / 5	N/A
All students	N/A	68 % / 19	50 % / 10	N/A
Do you support Int. Math for secondary schools?				
Yes	92 % / 23	79 % /110	84 % /118	81 % /128
No	4 % / 1	11 % / 16	9 % / 12	13 % / 20
Blank	4 % / 1	10 % / 14	7 % / 10	6 % / 9
If yes, for which students?				
College-bound	8 % / 2	11 % / 12	15 % / 17	10 % / 13
Non-college bound	4 % / 1	7 % / 8	8 % / 9	5 % / 6
All students	88 % / 22	82 % / 91	77 % / 89	85 % /110
Is your definition of Int. Math different from the working definition in the survey?				
Yes	32 % / 8	17 % / 24	6 % / 8	21 % / 34
No	68 % / 17	74 % /104	89 % /124	68 % /106
Blank	0 % / 0	9 % / 12	6 % / 8	11 % / 17

ANALYSIS OF RESULTS

The four principal investigators and a graduate assistant from the University of Washington met in Spokane, Washington, for two days in June, 1989, to draft a first version of a policy report regarding the implementation of an integrated mathematics program. The data from Figure I, Appendix C, and Table 2 provided the basis for discussion and the foundation of the draft policy statement mailed to the August conference participants. (These data were later used by the August conferees as basis for revising the outcomes and implications derived by the project leaders at their June meeting and for suggesting additional outcomes and implications.) The data analysis focused on information contributing to three areas of concern:

- *a definition of integrated mathematics;*
- *extent of interest in integrated mathematics at the state, district, and teacher preparation levels;*
- *implications of adopting such a program in secondary schools for professional organizations, colleges and universities, state departments of education, school systems, testing organizations, curriculum developers and publishers, and funding agencies.*

Responses to the working definition and Parts A and E along with written comments were studied to define integrated mathematics. The investigators found from Part E of the survey that a majority of respondents agreed with working definition of integrated mathematics provided on the project survey (see Appendix A). However, the respondents provided additional information in Part A of the survey which was used by the investigators to form a more complete definition. In addition, the investigators examined responses gathered from Part E of the survey instrument to determine the extent of interest in integrated mathematics at the state, district and teacher preparation levels.

Responses from Parts B, C, and D of the survey questionnaire were reviewed to determine implications of adopting an integrated mathematics program for the various affected groups. In addition, individual responses listing outcomes of and inhibitors to implementation of integrated programs were analyzed.

The product of this initial data analysis was a draft policy report on integrated mathematics. Following the June meeting, the draft was further reviewed and a second draft entitled "INTEGRATED MATHEMATICS PROGRAM: A POLICY STATEMENT", was completed in July, 1989.

A meeting was held in Spokane on August 25, 26, 27, 1989, with selected participants from Montana, Oregon, and Washington who reviewed the second draft of the policy report. The participant reviewers consisted of six college and university professors of mathematics or mathematics education, ten secondary mathematics teachers, a state mathematics curriculum supervisor, a representative from industry, and one graduate student in mathematics education. The group included the presidents and past presidents of the Montana Council of Teachers of Mathematics and the Washington State Mathematics Council. The invited participants had been sent a packet of material including the conference agenda, a list of participants, and the draft entitled "INTEGRATED MATHEMATICS PROGRAM: A POLICY STATEMENT" in July. The August meeting included presentations by the four investigators with both small and large group discussions. The purpose of the presentations and discussions was to provide the investigators with reactions to the draft. Proceedings were recorded by two participants for use in revising the draft. The conferees also completed a formal evaluation of the meeting (see Appendix F). The investigators met at the conclusion of the August meeting and again in October and November to write the following final policy report.

INTEGRATED MATHEMATICS PROJECT
A POLICY REPORT

SUPPORT FOR AN INTEGRATED MATHEMATICS PROGRAM

There is very strong support, from all groups, for movement to an integrated secondary mathematics program to meet the needs of all students. State and district supervisors indicate that this will take place within the next five years.

DEFINITION OF AN INTEGRATED MATHEMATICS PROGRAM

An integrated mathematics program for all students is a holistic mathematical curriculum which:

- *consists of topics chosen from a wide variety of mathematical fields and blends those topics to emphasize the connections and unity among those fields;*
- *emphasizes the relationships among topics within mathematics as well as between mathematics and other disciplines;*
- *each year, includes those topics at levels appropriate to students' abilities;*
- *is problem centered and application based;*
- *emphasizes problem-solving and mathematical reasoning;*
- *provides multiple contexts for students to learn mathematical concepts;*
- *provides continual reinforcement of concepts through successively expanding treatments of those concepts;*
- *makes use of appropriate technology.*

EXPECTED OUTCOMES

Students:

- *Students from all ability levels will take more mathematics with the greatest increase among those of average ability.*
- *Students will find mathematics more interesting, will have a greater understanding of mathematics, and will have less loss of skills over time.*
- *Students will be better prepared in mathematics with the greatest expectation for improvement in the noncollege-bound group.*
- *Student achievement scores on current standardized tests will not be adversely affected.*

Teachers:

- *There will be greater communication among teachers using an integrated mathematics program than those using a traditional program.*
- *Teachers will think of themselves as mathematics teachers rather than algebra or geometry teachers.*
- *Teachers will teach topics from a broader range of mathematical fields using multiple contexts.*

IMPLICATIONS

Professional Organizations

- *The National Council of Teachers of Mathematics, its affiliates, and other professional organizations must assume leadership in promoting and facilitating integrated mathematics programs.*

The publications, meetings, and inservice programs of professional mathematics organizations must endorse and promote integrated mathematics.

Colleges and Universities

- *College entrance requirements should be modified to accommodate an integrated mathematics program in secondary schools.*

Many institutions specify a requirement of Algebra I, Geometry, and Algebra II for college admissions. This specification of course titles could preclude the implementation of integrated mathematics programs in some states.

- *Colleges and universities must change existing entry-level courses to build upon the background of students who have taken integrated mathematics.*

Many institutions have college algebra, trigonometry, and pre-calculus as entry-level classes. To build upon the background of students who have taken integrated mathematics, these traditional courses should change to reflect an integrated approach.

- *Mathematics and mathematics education programs must emphasize an integrated view of mathematics and a variety of instructional methods including the use of technology.*

Traditionally, college and university mathematics courses are taught in isolation without viewing mathematics as a whole. Lecture is the general method of presentation. It is well documented that teachers teach as they have been taught. Therefore, preparing teachers to teach an integrated mathematics program demands some coursework in integrated mathematics and a variety of methods of instruction including strategies for connecting topics and utilizing technology.

State Departments of Education

- *State course guidelines must accommodate an integrated mathematics program.*

Specific course titles are included in syllabi for mathematics courses at the secondary level in some states. The implementation of an integrated mathematics program demands that specific titles should not be a part of the state guidelines.

- *State graduation requirements must accommodate an integrated mathematics program.*

In some states, graduation requirements for high schools include specific course titles. In order for an integrated mathematics program to be implemented in those states, these requirements must be changed.

- *State teacher certification standards must change to ensure that teachers are prepared to teach an integrated mathematics program.*

Many states demand specific mathematics and pedagogy courses as part of the teacher certification program. In order for an integrated mathematics program to be implemented in those states, the certification requirements must be reviewed and possibly changed to ensure that certified teachers are adequately prepared for teaching integrated mathematics programs.

- *State school accreditation standards must be changed to ensure that mathematics classrooms are staffed by certified mathematics teachers.*

Staffing mathematics classes with teachers adequately trained in the mathematics necessary to implement a quality integrated mathematics program will be a major problem for schools. Consequently, school accreditation standards should be

modified to ensure that all mathematics teachers at the secondary level have at least a minor in mathematics. Accreditation standards for schools should also reflect the requirement for continuous staff development in mathematics for those persons teaching mathematics.

School Systems

- *All school-related officials must become familiar with such national reform documents as the MSEB Everybody Counts and the NCTM Curriculum and Evaluation Standards for School Mathematics.*

- *All school-related officials must make the financial commitment necessary to implement and maintain an integrated mathematics program.*

Implementation of an integrated mathematics program necessitates a financial commitment from school districts for continued inservice, purchase of appropriate technologies, and possibly restructuring classroom environments in order to provide teachers with adequate materials and supplies to maintain such a program.

- *More teachers, prepared in mathematics and mathematics education, will be needed to teach integrated mathematics programs.*

As integrated mathematics programs attract more students to study mathematics, secondary schools will need more teachers prepared in mathematics and mathematics education for the additional classes. If state certification allows teachers with minimal preparation to teach courses up to and including Algebra I, then they would probably not be prepared to teach in an integrated program, even at the ninth-grade level. Minimal preparation may not include topics from probability, statistics, and discrete mathematics which are woven into an integrated program.

- *Continuing inservice for mathematics teachers must be provided to prepare them to teach in an integrated mathematics program.*

The implementation of an integrated mathematics program necessitates continuous inservice of current mathematics teachers to prepare them to teach such a program. Even those who are currently certified may be neither prepared to teach the blended sequence of topics with the different methods of presentation nor to utilize new technologies which are required for this teaching.

- *Policy makers, administrators and teachers must utilize available state and federal funds for providing inservice training for mathematics teachers.*

All school policy makers, administrators, and teachers should be aware of local and state funding that may be available for the implementation of an integrated mathematics program and the staff development necessary for teachers. All school personnel must become knowledgeable about the funding available from the Dwight D. Eisenhower Mathematics and Science Education Improvement Program which provides state departments of education, institutions of higher education, and local districts with specific dollars for staff development in the area of mathematics.

- *Students transferring between an integrated mathematics program and a traditional program may experience no more problems than those transferring among other mathematics programs.*

Problems of transfer between an integrated mathematics program and a traditional program may be no more significant than ordinary student transfer problems, such as, different textbooks, different teaching styles, and different requirements of a school or an instructor. The problems incurred by a student transferring between a

traditional and an integrated program may involve some background missed prior to the transfer.

Testing Organizations

- *An integrated mathematics program demands a shift in emphasis on test construction to focus on concepts, skills and applications characteristic of an integrated approach.*

- *All tests must be designed to accommodate the use of technology.*

An integrated mathematics program focuses on problem-centered learning, problem solving, the use of technology, and different approaches to mathematics. Current testing on procedures and skills must be replaced by open-ended questions, use of calculators and computers and a greater problem-solving focus.

Curriculum Developers and Publishers

- *Appropriate curriculum materials for an integrated mathematics program must be developed to meet the needs of all students.*

Curricular materials necessary to meet the needs of all students taking an integrated mathematics program are not currently available. Immediate steps must be taken by curriculum developers and publishers to develop these materials. Once materials are produced, publishers should be involved in and supportive of on-going inservice to assist teachers in successfully implementing integrated programs.

Funding Agencies

- *Governmental and private funding agencies must make integrated mathematics programs a priority focus of their funding programs.*

Because of the documented move to integrated mathematics programs, governmental and private funding agencies should fund projects which include curriculum and staff development at the secondary and collegiate levels, program and student assessment, and other research involving these programs. Agencies must encourage projects which include cooperative efforts among curriculum developers, publishers, and professional organizations.

Shared Responsibility Among All Groups

- *Integrated mathematics materials for all students must be developed.*

- *Inservice leaders must be prepared to facilitate the implementation of integrated mathematics programs.*

- *There is a need for research on all aspects regarding an integrated mathematics program.*

APPENDIX A

Cover Letter

Four Questionnaires

Montana Council of Teachers of Mathematics
AND
Washington State Mathematics Council

Dear Mathematics Supervisors:

We hope you will take the time to complete this brief three page survey concerning your knowledge about the general characteristics of Integrated Mathematics Programs at the secondary school level. As you know, integrated mathematics is the subject of greater and greater interest around the country; however, little information exists concerning the mathematics teaching community's understanding of the curriculum, instruction, and outcome issues associated with the concept of integrated mathematics. Consequently, your responses will provide us with substantial comprehensive information concerning this very important issue in mathematics teaching.

This survey is being mailed to all state mathematics supervisors and to a nationwide sample of mathematics teachers, department heads, and teacher educators. Please know that your participation is completely voluntary and that in all cases the anonymity of the respondent, the school, and the state will be protected.

Please return the questionnaire in the enclosed self-addressed stamped envelope by April 19, 1989.

Sincerely,

Jack L. Beal
Associate Professor
Mathematics Education
University of Washington

Johnny Lott
Professor of Mathematics
University of Montana

Dan Dolan
State Mathematics Supervisor
State of Montana

RETURN TO:
Professor Jack L. Beal
201 Miller Hall, DQ-12
University of Washington
Seattle, WA 98195

- This research is supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council.

Turn the page now to begin the survey.

Integrated Mathematics Project Survey
Mathematics Department Chair / District Supervisor

Please check Department Chair, District Supervisor, or Other and fill in related information:

☐ Department Chair ☐ District supervisor ☐ Other (specify)_____

Name of State_____ School Size_____ (number of students) District Size_____ (number of students)

School type: ☐ Urban ☐ Suburban ☐ Rural

Grades level: ☐ 7-12 ☐ 8-12 ☐ 9-12 ☐ 10-12 ☐ other _____

Working Definition of Integrated Mathematics

An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete courses.

Part A: Using the working definition as a frame of reference, respond to the following statements on the basis of their being a necessary component of an *Integrated Secondary School Mathematics Program* rather than just a necessary part of a good secondary school mathematics program.

An integrated secondary school mathematics program must:	Yes	No	Undecided
1. Have a spiral arrangement of content	☐	☐	☐
2. Provide continual reinforcement of ideas	☐	☐	☐
3. Use problems to organize content	☐	☐	☐
4. Use problems to organize instruction	☐	☐	☐
5. Include statistics	☐	☐	☐
6. Use logic to facilitate the understanding of mathematics	☐	☐	☐
7. Include transformational geometry	☐	☐	☐
8. Require problem-solving involving more than one area of mathematics	☐	☐	☐
9. Promote a holistic view of mathematics	☐	☐	☐
10. Be adaptable to student readiness	☐	☐	☐
11. Allow for flexibility in determining length of time devoted to a topic	☐	☐	☐
12. Include discrete mathematics	☐	☐	☐
13. Promote formal proof in all of mathematics	☐	☐	☐
14. Have frequent changes in topics	☐	☐	☐
15. Include probability	☐	☐	☐
16. Make use of available technology	☐	☐	☐
17. Include the construction, validation, and evaluation of logical arguments by students	☐	☐	☐
18. Provide multiple contexts for students to learn mathematical concepts	☐	☐	☐
19. Other program components not listed: _____			

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Part B: Teachers in an integrated secondary school mathematics program must:

		Yes	No	Undecided
1.	Use different teaching methods than those currently used	☐	☐	☐
2.	Have a different mathematics major than currently offered	☐	☐	☐
3.	Have a different preparation in pedagogy than currently offered	☐	☐	☐
4.	Be teachers of mathematics rather than algebra or geometry specialists	☐	☐	☐
5.	Other teacher characteristics not listed: _____			

Part C: Using the working definition as a frame of reference, respond to the following statements on the basis of their being necessary *outcomes* of an *Integrated Secondary School Mathematics Program* rather than just a necessary outcome of a good secondary mathematics program.

		Yes	No	Undecided
1.	Lower ability students will take more mathematics	☐	☐	☐
2.	Average ability students will take more mathematics	☐	☐	☐
3.	Higher ability students will take more mathematics	☐	☐	☐
4.	More students will complete 3 years of mathematics than now complete a first year algebra - geometry - second year algebra/trigonometry sequence	☐	☐	☐
5.	Regardless of when students quit taking mathematics, they will have a greater depth of understanding of mathematics	☐	☐	☐
6.	Students will have difficulty transferring from an integrated mathematics program to a traditional program	☐	☐	☐
7.	The loss of student mathematical skills will be minimized	☐	☐	☐
8.	College-bound students will be better prepared for college-level mathematics	☐	☐	☐
9.	College-bound students will be less prepared for college-level mathematics	☐	☐	☐
10.	Non-college bound students will be better prepared in mathematical life skills	☐	☐	☐
11.	Non-college bound students will be less prepared in mathematical life skills	☐	☐	☐
12.	Students will score higher on achievement tests in mathematics	☐	☐	☐
13.	Students will score lower on achievement tests in mathematics	☐	☐	☐
14.	Lower ability students will find integrated mathematics more interesting	☐	☐	☐
15.	Average ability students will find integrated mathematics more interesting	☐	☐	☐
16.	Higher ability students will find integrated mathematics more interesting	☐	☐	☐
17.	Communication about mathematics among teachers will be enhanced	☐	☐	☐
18.	Other outcomes not listed: _____			

Part D: Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program in your district/school?

		Yes	No	Undecided
1.	Lack of an awareness of such a program by school boards	☐	☐	☐
2.	Lack of an interest in such a program by school boards	☐	☐	☐
3.	Lack of an awareness of such a program by administrators	☐	☐	☐
4.	Lack of interest in such a program by administrators	☐	☐	☐
5.	Lack of an awareness of such a program by teachers	☐	☐	☐
6.	Lack of an interest in such a program by teachers	☐	☐	☐
7.	District mandated curriculum	☐	☐	☐
8.	District graduation requirements	☐	☐	☐
9.	Background of present teaching staff	☐	☐	☐
10.	Lack of money to support necessary inservice	☐	☐	☐

D.S.

Part D: Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program in your district/school?

	Yes	No	Undecided
11. College entrance requirements	☐	☐	☐
12. Lack of integrated secondary mathematics textbooks appropriate for ALL students	☐	☐	☐
13. Lack of good integrated secondary mathematics textbooks	☐	☐	☐
14. Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
15. Resistance from parents	☐	☐	☐
16. Lack of money to support costs of new textbooks	☐	☐	☐

17. Other inhibitors: _____

Part E: Please respond to the following questions

1. Does your district/school have any integrated secondary mathematics programs? Yes ☐ No ☐

   (a) If yes, which students are in the program (check one)?

   ☐ college-bound ☐ noncollege-bound ☐ all students

   If yes, what percent of your district's/department's graduates take integrated mathematics for:

   one year?_____ % two years?_____ % three years?_____ %

   If yes, which textbook series is used?

   ☐ Merrill ☐ Houghton-Mifflin ☐ Addison-Wesley

   ☐ Amsco ☐ Other(specify) _____

   (b) If no, do you anticipate a move toward this type of program in the future? Yes ☐ No ☐ Don't Know ☐

   (b.1) If yes, in the next ☐ 1-3 years ☐ 3-5 years ☐ > 5 years

   (b.2) If yes, which students do you intend to have in the program (check one)?

   ☐ college-bound ☐ noncollege-bound ☐ all students

2. Do you support the ideas of an integrated secondary mathematics program for secondary schools? Yes ☐ No ☐

   Please explain your choice:

   If yes, for which students (check one)? ☐ college-bound ☐ noncollege-bound ☐ all students

   Please explain your choice:

3. Is your definition of an integrated secondary mathematics program different from the working definition in this survey? If yes, what is your definition? Yes ☐ No ☐

Please return to: Dr. Jack Beal, College of Education, 211 Miller Hall DQ-12, University of Washington, Seattle, WA 98195

D.S.

Montana Council of Teachers of Mathematics
AND
Washington State Mathematics Council

Dear State Mathematics Supervisors:

We hope you will take the time to complete this brief three page survey concerning your knowledge about the general characteristics of Integrated Mathematics Programs at the secondary school level. As you know, integrated mathematics is the subject of greater and greater interest around the country; however, little information exists concerning the mathematics teaching community's understanding of the curriculum, instruction, and outcome issues associated with the concept of integrated mathematics. Consequently, your responses will provide us with substantial comprehensive information concerning this very important issue in mathematics teaching.

This survey is being mailed to all state mathematics supervisors and to a nationwide sample of mathematics teachers, department heads, and teacher educators. Please know that your participation is completely voluntary and that in all cases the anonymity of the respondent, the school, and the state will be protected.

Please return the questionnaire in the enclosed self-addressed stamped envelope by April 19, 1989.

Sincerely,

Jack L. Beal
Associate Professor
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State of Montana

RETURN TO:
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Seattle, WA 98195

• This research is supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council.

Turn the page now to begin the survey.

Integrated Mathematics Project Survey

State Mathematics Supervisors

_____

Name of State

Working Definition of Integrated Mathematics

An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete courses.

Part A: Using the working definition as a frame of reference, respond to the following statements on the basis of their being a necessary component of an *Integrated Secondary School Mathematics Program* rather than just a necessary part of a good secondary school mathematics program.

An integrated secondary school mathematics program must:	Yes	No	Undecided
1. Have a spiral arrangement of content	☐	☐	☐
2. Provide continual reinforcement of ideas	☐	☐	☐
3. Use problems to organize content	☐	☐	☐
4. Use problems to organize instruction	☐	☐	☐
5. Include statistics	☐	☐	☐
6. Use logic to facilitate the understanding of mathematics	☐	☐	☐
7. Include transformational geometry	☐	☐	☐
8. Require problem-solving involving more than one area of mathematics	☐	☐	☐
9. Promote a holistic view of mathematics	☐	☐	☐
10. Be adaptable to student readiness	☐	☐	☐
11. Allow for flexibility in determining length of time devoted to a topic	☐	☐	☐
12. Include discrete mathematics	☐	☐	☐
13. Promote formal proof in all of mathematics	☐	☐	☐
14. Have frequent changes in topics	☐	☐	☐
15. Include probability	☐	☐	☐
16. Make use of available technology	☐	☐	☐
17. Include the construction, validation, and evaluation of logical arguments by students	☐	☐	☐
18. Provide multiple contexts for students to learn mathematical concepts	☐	☐	☐
19. Other program components not listed: _____			

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Part B: Teachers in an integrated secondary school mathematics program must:

		Yes	No	Undecided
1.	Use different teaching methods than those currently used	☐	☐	☐
2.	Have a different mathematics major than currently offered	☐	☐	☐
3.	Have a different preparation in pedagogy than currently offered	☐	☐	☐
4.	Be teachers of mathematics rather than algebra or geometry specialists	☐	☐	☐
5.	Other teacher characteristics not listed: _____			

_____

Part C: Using the working definition as a frame of reference, respond to the following statements on the basis of their being necessary *outcomes* of an *Integrated Secondary School Mathematics Program* rather than just a necessary outcome of a good secondary mathematics program.

		Yes	No	Undecided
1.	Lower ability students will take more mathematics	☐	☐	☐
2.	Average ability students will take more mathematics	☐	☐	☐
3.	Higher ability students will take more mathematics	☐	☐	☐
4.	More students will complete 3 years of mathematics than ~~now~~ complete a first year algebra - geometry - second year algebra/trigonometry sequence	☐	☐	☐
5.	Regardless of when students quit taking mathematics, they will have a greater depth of understanding of mathematics	☐	☐	☐
6.	Students will have difficulty transferring from an integrated mathematics program to a traditional program	☐	☐	☐
7.	The loss of student mathematical skills will be minimized	☐	☐	☐
8.	College-bound students will be better prepared for college-level mathematics	☐	☐	☐
9.	College-bound students will be less prepared for college-level mathematics	☐	☐	☐
10.	Non-college bound students will be better prepared in mathematical life skills	☐	☐	☐
11.	Non-college bound students will be less prepared in mathematical life skills	☐	☐	☐
12.	Students will score higher on achievement tests in mathematics	☐	☐	☐
13.	Students will score lower on achievement tests in mathematics	☐	☐	☐
14.	Lower ability students will find integrated mathematics more interesting	☐	☐	☐
15.	Average ability students will find integrated mathematics more interesting	☐	☐	☐
16.	Higher ability students will find integrated mathematics more interesting	☐	☐	☐
17.	Communication about mathematics among teachers will be enhanced	☐	☐	☐
18.	Other outcomes not listed: _____			

_____

S.S.

Part D: Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program in your state?

		Yes	No	Undecided
1.	Lack of an awareness of such a program by policy makers	☐	☐	☐
2.	Lack of an interest in such a program by policy makers	☐	☐	☐
3.	Lack of an awareness of such a program by educators	☐	☐	☐
4.	Lack of an interst in such a program by educators	☐	☐	☐
5.	State mandated curriculum	☐	☐	☐
6.	State graduation requirements	☐	☐	☐
7.	Present preservice teacher preparation programs	☐	☐	☐
8.	Background of present teaching staff	☐	☐	☐
9.	Lack of money to support necessary inservice	☐	☐	☐
10.	College entrance requirements	☐	☐	☐
11.	Lack of integrated secondary mathematics curricular materials appropriate to meet the needs of ALL students	☐	☐	☐
12.	Current integrated secondary mathematics curriculum materials do not meet the intent of an integrated program	☐	☐	☐
13.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
14.	Logistics of inservice training of large numbers of teachers	☐	☐	☐
15.	Other inhibitors: _____			

Part E: Please respond to the following questions

		Yes	No	Don't Know
1.	Does your state have any integrated secondary mathematics programs?	☐	☐	
	(a) If yes, what percent of all secondary school students participate? _____ %			
	(b) If no, do you anticipate any schools/districts moving toward this type of program in the future?	☐	☐	☐
	(b.1) If yes, in the next ☐ 1-3 years ☐ 3-5 years ☐ > 5 years			
	(b.2) If yes, what percent of all secondary school students will participate? _____ %			
2.	Do you support the ideas of an integrated secondary mathematics program for secondary schools?	☐	☐	
	Please explain your choice:			
	If yes, for which students (check one)? ☐ college-bound ☐ noncollege-bound ☐ all students			
	Please explain your choice:			
3.	Is your definition of an integrated secondary mathematics program different from the working definition in this survey? If yes, what is your definition?	☐	☐	

S.S.

Please return to: **Dr. Jack Beal, College of Education, 211 Miller Hall DQ-12, University of Washington, Seattle, WA 98195**

Montana Council of Teachers of Mathematics
AND
Washington State Mathematics Council

Dear Teacher Educators:

We hope you will take the time to complete this brief three page survey concerning your knowledge about the general characteristics of Integrated Mathematics Programs at the secondary school level. As you know, integrated mathematics is the subject of greater and greater interest around the country; however, little information exists concerning the mathematics teaching community's understanding of the curriculum, instruction, and outcome issues associated with the concept of integrated mathematics. Consequently, your responses will provide us with substantial comprehensive information concerning this very important issue in mathematics teaching.

This survey is being mailed to all state mathematics supervisors and to a nationwide sample of mathematics teachers, department heads, and teacher educators. Please know that your participation is completely voluntary and that in all cases the anonymity of the respondent, the school, and the state will be protected.

Please return the questionnaire in the enclosed self-addressed stamped envelope by April 19, 1989.

Sincerely,

Jack L. Beal
Associate Professor
Mathematics Education
University of Washington

Johnny Lott
Professor of Mathematics
University of Montana

Dan Dolan
State Mathematics Supervisor
State of Montana

RETURN TO:
Professor Jack L. Beal
201 Miller Hall, DQ-12
University of Washington
Seattle, WA 98195

- This research is supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council.

Turn the page now to begin the survey.

Integrated Mathematics Project Survey
Teacher Educators - Mathematics

Name of State_____

Size of Institution _____
(Number of students)

Check one: ☐ Public ☐ Private

Check one: ☐ Mathematics Department ☐ Education Department ☐ Other _____
(Specify)

Working Definition of Integrated Mathematics

An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete courses.

Part A: Using the working definition as a frame of reference, respond to the following statements on the basis of their being a necessary component of an *Integrated Secondary School Mathematics Program* rather than just a necessary part of a good secondary school mathematics program.

An integrated secondary school mathematics program must:	Yes	No	Undecided
1. Have a spiral arrangement of content	☐	☐	☐
2. Provide continual reinforcement of ideas	☐	☐	☐
3. Use problems to organize content	☐	☐	☐
4. Use problems to organize instruction	☐	☐	☐
5. Include statistics	☐	☐	☐
6. Use logic to facilitate the understanding of mathematics	☐	☐	☐
7. Include transformational geometry	☐	☐	☐
8. Require problem-solving involving more than one area of mathematics	☐	☐	☐
9. Promote a holistic view of mathematics	☐	☐	☐
10. Be adaptable to student readiness	☐	☐	☐
11. Allow for flexibility in determining length of time devoted to a topic	☐	☐	☐
12. Include discrete mathematics	☐	☐	☐
13. Promote formal proof in all of mathematics	☐	☐	☐
14. Have frequent changes in topics	☐	☐	☐
15. Include probability	☐	☐	☐
16. Make use of available technology	☐	☐	☐
17. Include the construction, validation, and evaluation of logical arguments by students	☐	☐	☐
18. Provide multiple contexts for students to learn mathematical concepts	☐	☐	☐
19. Other program components not listed: _____			

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Part B: Teachers in an integrated secondary school mathematics program must:

		Yes	No	Undecided
1.	Use different teaching methods than those currently used	☐	☐	☐
2.	Have a different mathematics major than currently offered	☐	☐	☐
3.	Have a different preparation in pedagogy than currently offered	☐	☐	☐
4.	Be teachers of mathematics rather than algebra or geometry specialists	☐	☐	☐
5.	Other teacher characteristics not listed: _____			

Part C: Using the working definition as a frame of reference, respond to the following statements on the basis of their being necessary *outcomes* of an *Integrated Secondary School Mathematics Program* rather than just a necessary outcome of a good secondary mathematics program.

		Yes	No	Undecided
1.	Lower ability students will take more mathematics	☐	☐	☐
2.	Average ability students will take more mathematics	☐	☐	☐
3.	Higher ability students will take more mathematics	☐	☐	☐
4.	More students will complete 3 years of mathematics than now complete a first year algebra - geometry - second year algebra/trigonometry sequence	☐	☐	☐
5.	Regardless of where students quit taking mathematics, they will have a greater depth of understanding of mathematics	☐	☐	☐
6.	Students will have difficulty transferring from an integrated mathematics program to a traditional program	☐	☐	☐
7.	The loss of student mathematical skills will be minimized	☐	☐	☐
8.	College-bound students will be better prepared for college-level mathematics	☐	☐	☐
9.	College-bound students will be less prepared for college-level mathematics	☐	☐	☐
10.	Non-college bound students will be better prepared in mathematical life skills	☐	☐	☐
11.	Non-college bound students will be less prepared in mathematical life skills	☐	☐	☐
12.	Students will score higher on achievement tests in mathematics	☐	☐	☐
13.	Students will score lower on achievement tests in mathematics	☐	☐	☐
14.	Lower ability students will find integrated mathematics more interesting	☐	☐	☐
15.	Average ability students will find integrated mathematics more interesting	☐	☐	☐
16.	Higher ability students will find integrated mathematics more interesting	☐	☐	☐
17.	Communicationabout mathematics among teachers will be enhanced	☐	☐	☐
18.	Other outcomes not listed: _____			

Part D: Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program?

		Yes	No	Undecided
1.	Lack of an awareness of such a program by policy makers	☐	☐	☐
2.	Lack of an interest in such a program by policy makers	☐	☐	☐
3.	Lack of an awareness of such a program by secondary mathematics teachers	☐	☐	☐
4.	Lack of an interest in such a program by secondary mathematics teachers	☐	☐	☐
5.	Lack of an awareness of such a program by college/university mathematics educators	☐	☐	☐
6.	Lack of an interest in such a program by college/university mathematics educators	☐	☐	☐

T.E.

Part D (cont): Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program?

		Yes	No	Undecided
7.	Would require change in the preservice teacher preparation program	☐	☐	☐
8.	Background of present teaching staff in the state	☐	☐	☐
9.	Not useful in the foreseeable future	☐	☐	☐
10.	Lack of money to support necessary inservice	☐	☐	☐
11.	College entrance requirements at your institution	☐	☐	☐
12.	Lack of secondary mathematics curricular materials appropriate to meet the needs of ALL students	☐	☐	☐
13.	Not contained in present methods textbooks	☐	☐	☐
14.	Current integrated secondary mathematics curriculum materials do not meet the intent of an integrated program	☐	☐	☐
15.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
16.	Considered to be a "fad"	☐	☐	☐
17.	Current mathematics majors offered by institutions are not appropriate	☐	☐	☐
18.	Lack of supplementary materials	☐	☐	☐
19.	Amount of time needed for inservice is overwhelming even though money is available	☐	☐	☐

Part E: Please respond to the following questions

1. If an integrated mathematics program was mandated in your state, how would this affect:
   a. Methods courses

   b. Mathematics courses

   c. Student teaching

   d. College entrance requirements at your institution

2. Do you support the idea of an integrated secondary mathematics program for secondary schools? Yes ☐ No ☐
   Please explain your choice:

   If yes, for which students? ☐ college-bound ☐ noncollege-bound ☐ all students
   Please explain your choice:

3. Is your definition of an integrated secondary mathematics program different from the working definition of this survey? If yes, what is your definition? Yes ☐ No ☐

T.E.

Please return to: **Dr. Jack Beal, College of Education, 211 Miller Hall DQ-12, University of Washington, Seattle, WA 98195**

Montana Council of Teachers of Mathematics
AND
Washington State Mathematics Council

Dear Mathematics Teacher:

We hope you will take the time to complete this brief three page survey concerning your knowledge about the general characteristics of Integrated Mathematics Programs at the secondary school level. As you know, integrated mathematics is the subject of greater and greater interest around the country; however, little information exists concerning the mathematics teaching community's understanding of the curriculum, instruction, and outcome issues associated with the concept of integrated mathematics. Consequently, your responses will provide us with substantial comprehensive information concerning this very important issue in mathematics teaching.

This survey is being mailed to all state mathematics supervisors and to a nationwide sample of mathematics teachers, department heads, and teacher educators. Please know that your participation is completely voluntary and that in all cases the anonymity of the respondent, the school, and the state will be protected.

Please return the questionnaire in the enclosed self-addressed stamped envelope by April 19, 1989.

Sincerely,

Jack L. Beal
Associate Professor
Mathematics Education
University of Washington

Johnny Lott
Professor of Mathematics
University of Montana

Dan Dolan
State Mathematics Supervisor
State of Montana

RETURN TO:
Professor Jack L. Beal
201 Miller Hall, DQ-12
University of Washington
Seattle, WA 98195

- This research is supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council.

Turn the page now to begin the survey.

Integrated Mathematics Project Survey
Mathematics Teachers

Name of State_____ School Size_____ (number of students) District Size_____ (number of students)

School type: ☐ Urban ☐ Suburban ☐ Rural

Grade level: ☐ 7-12 ☐ 8-12 ☐ 9-12 ☐ other _____
☐ 7-9 ☐ 8-9 ☐ 10-12

Working Definition of Integrated Mathematics

An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete courses.

Part A: Using the working definition as a frame of reference, respond to the following statements on the basis of their being a necessary component of an *Integrated Secondary School Mathematics Program* rather than just a necessary part of a good secondary school mathematics program.

An integrated secondary school mathematics program must:	Yes	No	Undecided
1. Have a spiral arrangement of content	☐	☐	☐
2. Provide continual reinforcement of ideas	☐	☐	☐
3. Use problems to organize content	☐	☐	☐
4. Use problems to organize instruction	☐	☐	☐
5. Include statistics	☐	☐	☐
6. Use logic to facilitate the understanding of mathematics	☐	☐	☐
7. Include transformational geometry	☐	☐	☐
8. Require problem-solving involving more than one area of mathematics	☐	☐	☐
9. Promote a holistic view of mathematics	☐	☐	☐
10. Be adaptable to student readiness	☐	☐	☐
11. Allow for flexibility in determining length of time devoted to a topic	☐	☐	☐
12. Include discrete mathematics	☐	☐	☐
13. Promote formal proof in all of mathematics	☐	☐	☐
14. Have frequent changes in topics	☐	☐	☐
15. Include probability	☐	☐	☐
16. Make use of available technology	☐	☐	☐
17. Include the construction, validation, and evaluation of logical arguments by students	☐	☐	☐
18. Provide multiple contexts for students to learn mathematical concepts	☐	☐	☐
19. Other program components not listed: _____			

Supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council

Part B: Teachers in an integrated secondary school mathematics program must:

		Yes	No	Undecided
1.	Use different teaching methods than those currently used	☐	☐	☐
2.	Have a different mathematics major than currently offered	☐	☐	☐
3.	Have a different preparation in pedagogy than currently offered	☐	☐	☐
4.	Be teachers of mathematics rather than algebra or geometry specialists	☐	☐	☐
5.	Other teacher characteristics not listed: _____			

_____

Part C: Using the working definition as a frame of reference, respond to the following statements on the basis of their being necessary *outcomes* of an *Integrated Secondary School Mathematics Program* rather than just a necessary outcome of a good secondary school mathematics program.

		Yes	No	Undecided
1.	Lower ability students will take more mathematics	☐	☐	☐
2.	Average ability students will take more mathematics	☐	☐	☐
3.	Higher ability students will take more mathematics	☐	☐	☐
4.	More students will complete 3 years of mathematics than now complete a first year algebra - geometry - second year algebra/trigonometry sequence	☐	☐	☐
5.	Regardless of when students quit taking mathematics, they will have a greater depth of understanding of mathematics	☐	☐	☐
6.	Students will have difficulty transferring from an integrated mathematics program to a traditional program	☐	☐	☐
7.	The loss of student mathematical skills will be minimized	☐	☐	☐
8.	College-bound students will be better prepared for college-level mathematics	☐	☐	☐
9.	College-bound students will be less prepared for college-level mathematics	☐	☐	☐
10.	Non-college bound students will be better prepared in mathematical life skills	☐	☐	☐
11.	Non-college bound students will be less prepared in mathematical life skills	☐	☐	☐
12.	Students will score higher on achievement tests in mathematics	☐	☐	☐
13.	Students will score lower on achievement tests in mathematics	☐	☐	☐
14.	Lower ability students will find integrated mathematics more interesting	☐	☐	☐
15.	Average ability students will find integrated mathematics more interesting	☐	☐	☐
16.	Higher ability students will find integrated mathematics more interesting	☐	☐	☐
17.	Communication about mathematics among teachers will be enhanced	☐	☐	☐
18.	Other outcomes not listed: _____			

_____

M.T.

Part D: Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program in your district/school?

		Yes	No	Undecided
1.	Lack of an awareness of such a program by school board members	☐	☐	☐
2.	Lack of an interest in such a program by school board members	☐	☐	☐
3.	Lack of an awareness of such a program by administrators	☐	☐	☐
4.	Lack of an interest in such a program by administrators	☐	☐	☐
5.	Lack of an awareness of such a program by teachers	☐	☐	☐
6.	Lack of an interest in such a program by teachers	☐	☐	☐
7.	Lack of good integrated mathematics textbooks	☐	☐	☐
8.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
9.	Threat to status quo	☐	☐	☐
10.	Cost of changing to a new program	☐	☐	☐
11	Other inhibitors: _____			

Part E: Please respond to the following questions

1. Does your school have any integrated secondary mathematics programs? ..... Yes ☐ No ☐

   (a) If yes, which students are in the program (check one)?
   ☐ college-bound ☐ noncollege-bound ☐ all students

   If yes, which textbook series is used?
   ☐ Merrill ☐ Houghton-Mifflin ☐ Addison-Wesley
   ☐ Amsco ☐ Other (specify)_____

   (b) If no, do you anticipate a move toward this type of program in the future? Yes ☐ No ☐ Don't Know ☐
   (b.1) If yes, in the next ☐ 1-3 years ☐ 3-5 years ☐ > 5 years
   (b.2) If yes, which students do you intend to have in the program (check one)?
   ☐ college-bound ☐ noncollege-bound ☐ all students

2. Do you support the ideas of an integrated secondary mathematics program for secondary schools? ..... Yes ☐ No ☐
   Please explain your choice:

   If yes, for which students (check one)? ☐ college-bound ☐ noncollege-bound ☐ all students
   Please explain your choice:

3. Is your definition of an integrated secondary mathematics program different from the working definition? If yes, what is your definition? ..... Yes ☐ No ☐

Please return to: **Dr. Jack Beal, College of Education, 211 Miller Hall DQ-12, University of Washington, Seattle, WA 98195** M.T.

APPENDIX B

National Demographic Data

Appendix B
Demographic Data

Mathematics Teachers (N = 140)

School Type		
Urban	31 %	/ 44
Suburban	42 %	/ 59
Rural	21 %	/ 29
Not given	6 %	/ 8
Grade Level		
7-12	9 %	/ 13
8-12	3 %	/ 4
9-12	55 %	/ 77
7-9	9 %	/ 12
8-9	0 %	/ 0
10-12	6 %	/ 8
Other	19 %	/ 26
School Size		
Minimum	125	
Maximum	4000	
Median	989	
District Size		
Minimum	20	
Maximum	435000	
Median	2860	

Teacher Educators (N = 157)

Department of Respondent		
Mathematics	76 %	/119
Education	14 %	/ 22
Other	10 %	/ 16
School Type		
Public	77 %	/121
Private	15 %	/ 24
Not given	8 %	/ 12
Size of Institution		
Minimum	300	
Maximum	62000	
Median	7800	

Appendix B (cont.)
Demographic Data

Mathematics Supervisors (N = 140)

Title of Respondent		
Department Chair	15 %	/ 21
District Supervisor	55 %	/ 77
Other	30 %	/ 42
School Type		
Urban	26 %	/ 36
Suburban	36 %	/ 50
Rural	10 %	/ 14
Not given	29 %	/ 40
Grade Level		
7-12	17 %	/ 24
8-12	1 %	/ 2
9-12	23 %	/ 32
10-12	4 %	/ 5
Other	55 %	/ 77
District Size		
Minimum	80	
Maximum	595000	
Median	9350	

APPENDIX C

National Survey Results

C-1 State Supervisors

C-2 Mathematics Department Chairs/Supervisors

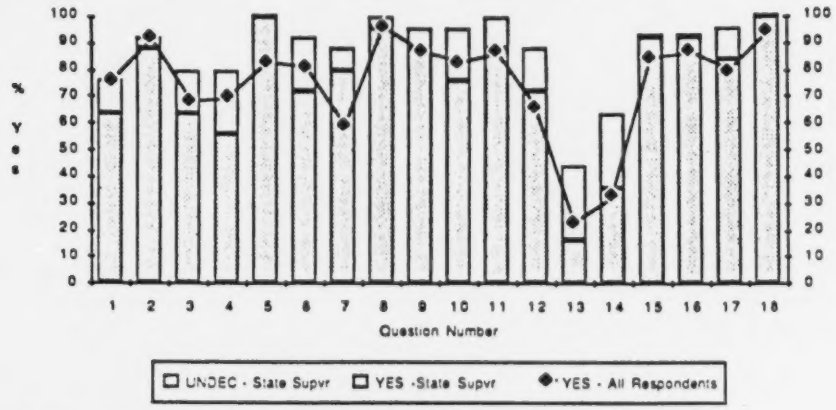
C-3 Mathematics Teachers

C-4 Teacher Educators

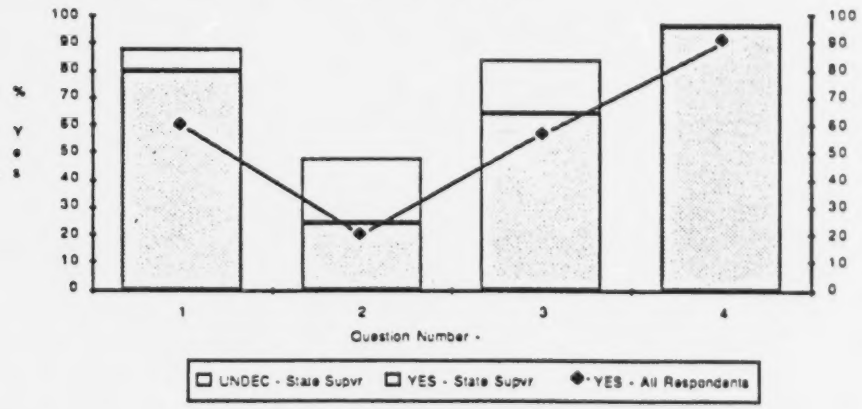
C-5 Responses to Open-ended Questions

Appendix C - 1
State Mathematics Supervisors
Responses by Item

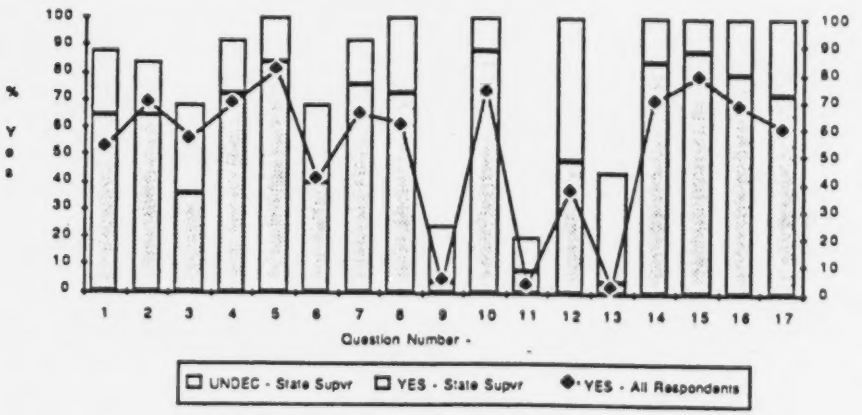
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

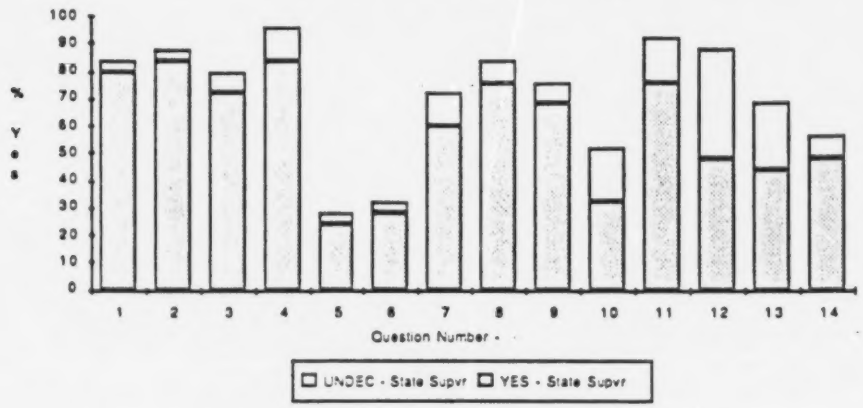


PART C: Outcomes of an Integrated Program



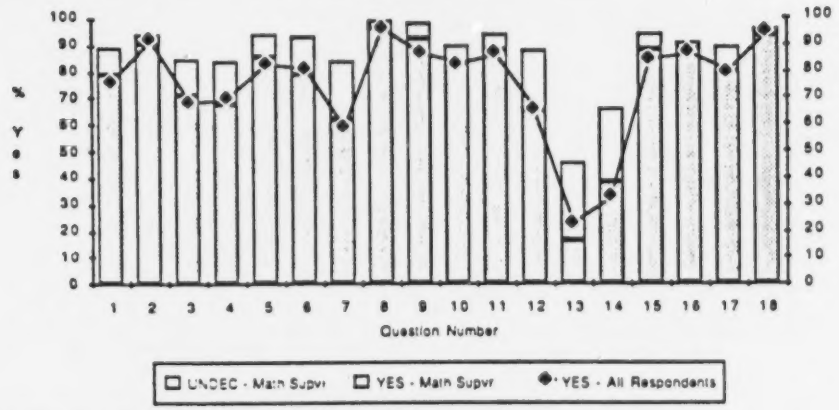
Appendix C - 1 (cont)
State Mathematics Supervisors
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics

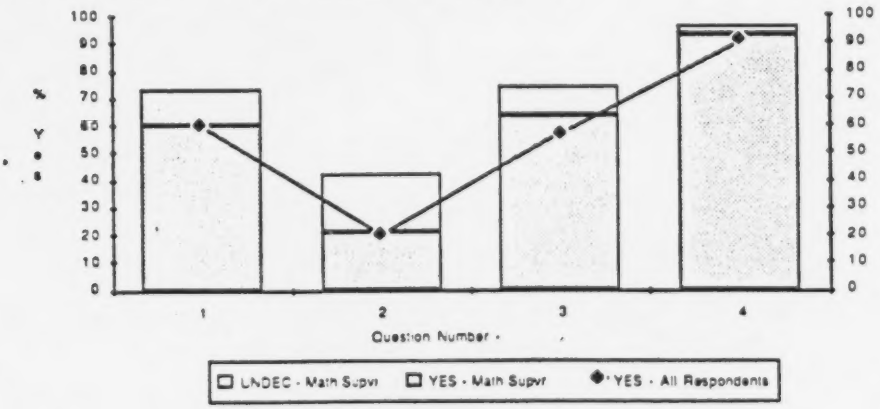


Appendix C - 2
Mathematics Supervisors
Responses by Item

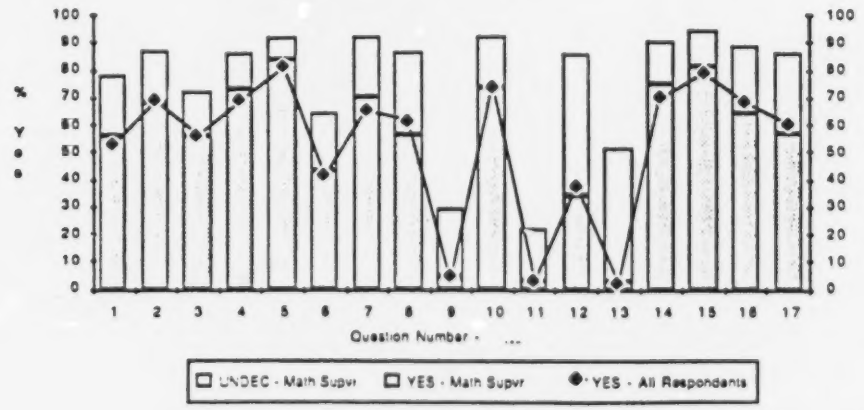
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

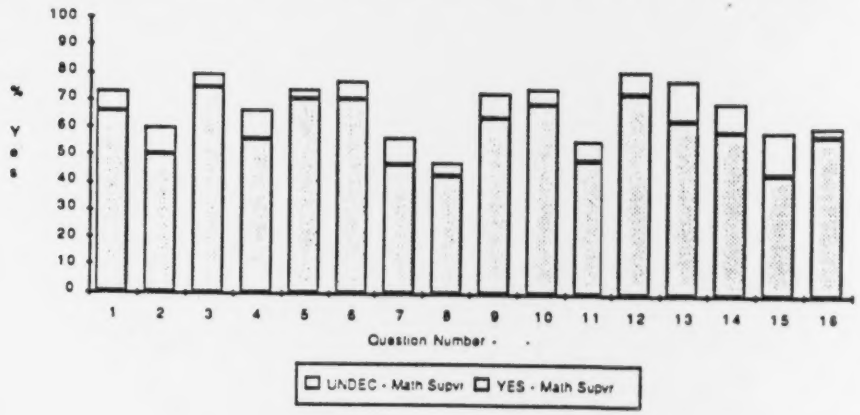


PART C: Outcomes of an Integrated Program



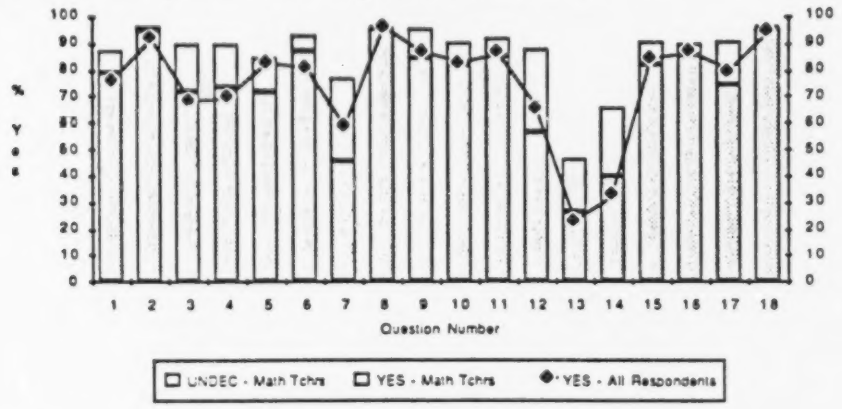
Appendix C - 2 (cont)
Mathematics Supervisors
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics

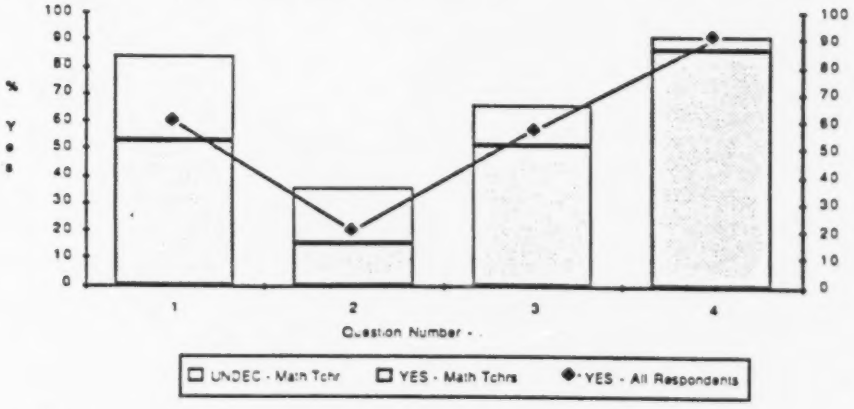


Appendix C - 3
Mathematics Teachers
Responses by Item

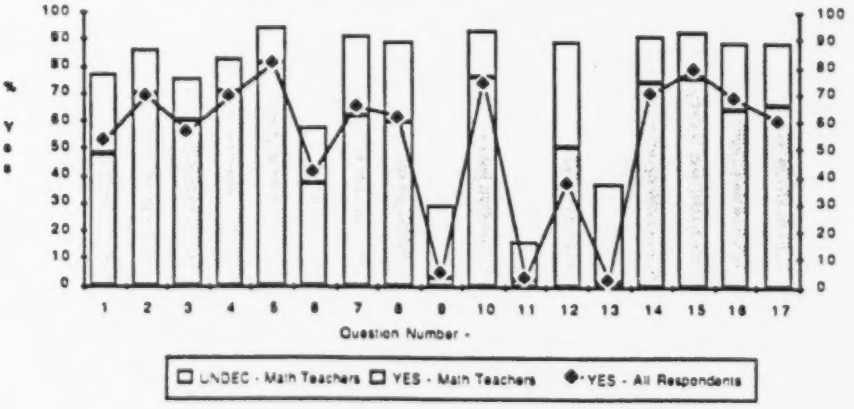
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

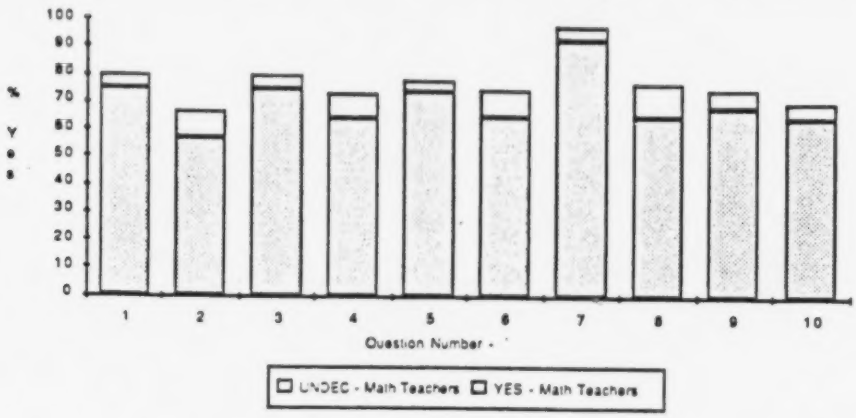


PART C: Outcomes of an Integrated Program



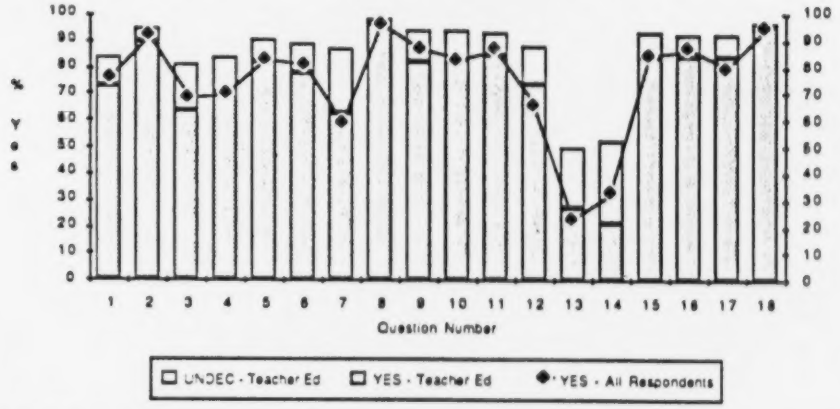
Appendix C - 3 (cont)
Mathematics Teachers
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics

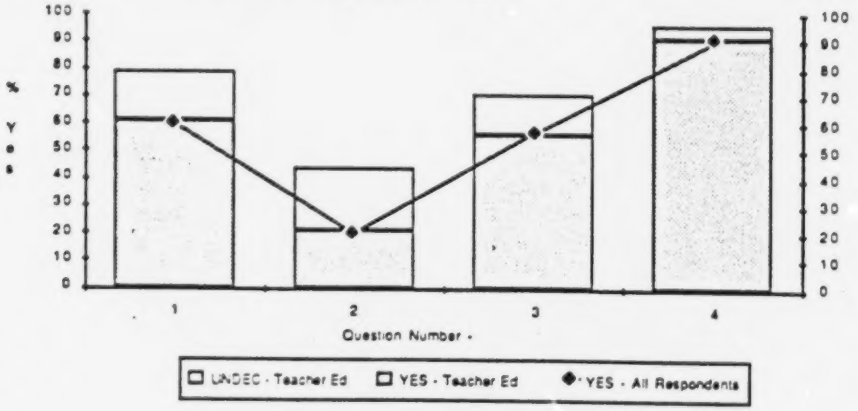


Appendix C - 4
Teacher Educators
Responses by Item

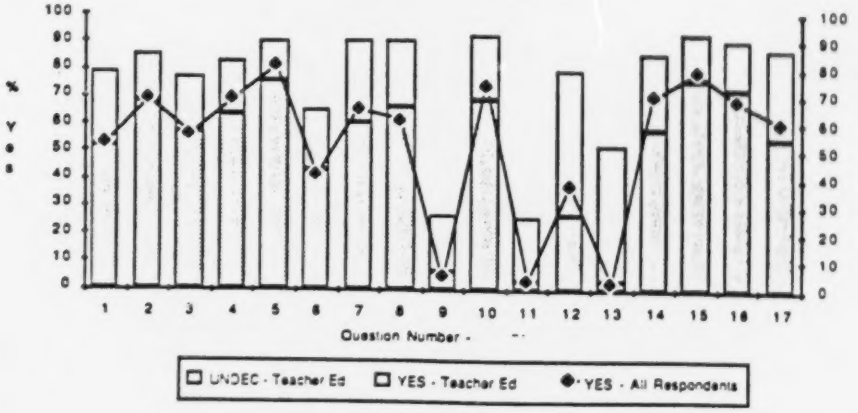
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

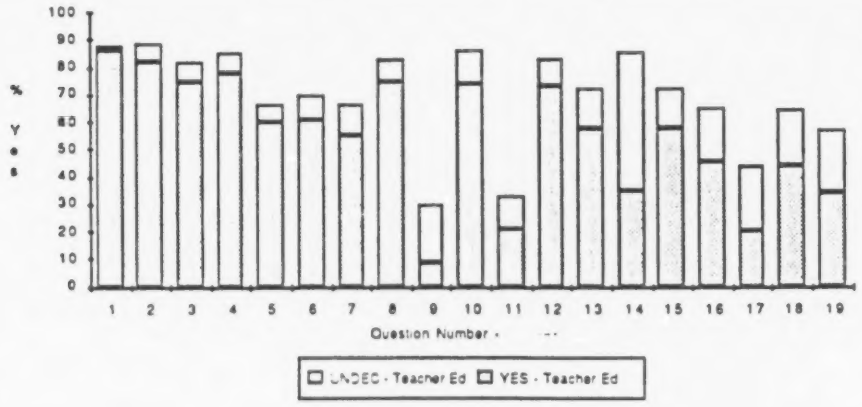


PART C: Outcomes of an Integrated Program



Appendix C - 4 (cont)
Teacher Educators
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics



Appendix C - 5

Responses to Open-ended Questions

Below you will find examples of survey responses to the open-ended questions.

Question A19 : Other Components of Integrated Mathematics

- There must really be integration of topics. A mere smorgasbord of topics is useless. Also, algebraic skills must be maintained.
- Must appeal to several ability levels at the same time. It is possible!
- Finite mathematics
- Students should be taught to ask themselves whether the answer they have is reasonable - be able to estimate what the answer should be - a general "ball park" number, etc.
- Career opportunities
- Involve students actively in doing mathematics
- Communications, reasoning, estimation, number sense, spatial sense, connectiveness
- Clearly defined goals with respect to integration of topics and the nature of the 2, 3, 4 year sequence
- Must be enhanced with cooperative learning
- Functions should be the organizing concept
- Materials and guides for teachers - let's not dump yet another expectation on them
- Include short and long term projects
- Each concept must be demonstrated through the use of physical models
- Different methods of solution must be encouraged
- Encourage creativity
- Be centered on problem solving
- Use multiple representations for the same situation (e.g. motion represented verbally, diagrammatically, pictorially, graphically, algebraically, etc.)

- Consumer math in all math courses (life skills such as taxes, mortgages, etc.)
- Analytic geometry including the study of line and properties, slopes, etc.
- Physical math lab experiences
- Compare and contrast similarities and differences between algebra & geometry
- Lots of practice problems
- Good testing program
- Informal proof can be used frequently without sacrificing extensive amounts of time
- Promote the use of calculators
- Teach actively, not page by page in text. Use a variety of materials and activities
- Provide for adjustable time needs
- Include other disciplines such as science, social studies, language arts and utilize problem solving from industry
- Include calculus
- Spiral approach is important, but it is important to build, not to continually go back to the beginning
- Graph construction and interpretation
- See UCSMP 7-12 Curriculum

Question B5: Teachers in an integrated program must:

- Have preparation in how learning takes place, must understand what constuctivism is all about
- Some new course might have to be required
- Show an interest in teaching
- Be capable of relating concepts to one another
- Must understand problem solving in and with mathematics
- Have experience with problem solving and manipulatives
- A life-long learner of math and math teaching
- Have a science background from which to draw examples, especially physics
- Like their pupils, are more concerned with pupil learning than grading
- Be process-oriented rather than product-oriented
- Be aware of elementary mathematics methodology and be able to integrate it into the secondary level
- Must teach by developing concepts
- Must consider different student learning styles
- Have a broad liberal arts education as well as a major in mathematics
- Be knowledgeable about affective matters
- Math profs must be concerned as to how children learn and get this across to college students
- Understand the characteristics of healthy interpersonal communication
- Strong background in all major areas of math
- The normal math education background of a teacher candidate is sufficient for teaching an integrated mathematics program
- Have good questioning techniques

- Be teachers of students not textbooks. Have great flexibility and willingness to supplement given text to meet students' needs and interests
- Socratic methods, employed extensively
- Willing to try new ideas, methods; willing to receive training
- Creative, caring, love children
- Have computer background
- Flexible, willing to take chances, be able to relinquish the role of teacher as the purveyor of knowledge, but instead, as a facilitator
- Many teachers in small schools teach all mathematics and few changes in preparation would be required
- Use a variety of teaching methods: cooperative groups, computers
- Restructure math education program
- Continue with their own education in the math field
- Competence, rigor, stress education rather than memory
- Encourage more than one approach to problems. I approach trig from a transformational geometry direction
- Wider base of knowledge, more breadth, depth
- Have a clear understanding of their clientele and the history and cultural implications of math and science
- A good command of other disciplines. See Man-Made World
- Have improved pedagogy
- Have a different attitude about the nature of mathematics
- Use calculators and technology (computers - large screen projection device, graphing calculators and function plotters)

Question C18: Necessary outcomes:

- Students will be more self-assured of their math ability. Teachers will have less math anxiety
- Revitalized staff
- Mathematics concepts will be enhanced
- I feel that the topic of difficulty of transferring between mathematics programs should be a topic for discussion at conferences
- Students might see a relationship between various subjects that are now taught as discrete courses
- The mathematics curriculum in the U.S. will be more closely aligned with the curriculum offered in foreign countries
- Standardized tests must change to reflect changes in math curriculum
- Students should have a greater understanding of the concept taught and the necessary relationship of algebra and geometry
- Fourth-year students (those taking pre-calculus) should be better prepared and have a greater understanding
- Teachers will have more interest in math
- Greater sharing of ideas among students
- Increased self-esteem of low to average students. "I can do it!"
- Such an integrated math course would most probably change students' attitude about upper division math courses and lead more to college-bound courses - even starting at the junior college level. It could extend their thinking about entering college and becoming a successful college student. Nevertheless, it would give them more challenging work than is being offered from grades 7-12.
- Will have improved conceptual skills and be able to apply them in problem solving
- Greater investment of student time will be required, expectation for student achievement will need to be higher
- There have been no significant differences in achievement test outcomes
- Interdisciplinary projects will emerge

- Reduce dropout rates
- Are college level beginning courses going to change also?
- Students can communicate more
- Will not do any more than can be done in a regular program when taught by good teaching
- All students will have better problem solving skills
- Teaching math will be more interesting
- Cross-content integration will occur. Students will see connections across disciplines
- Depends greatly on how courses are pitched and how universities view them

Question D11: Inhibitors:

- Inability of specialized teachers to handle all areas of mathematics - a fearsome task for some
- Constant changing of topics, tendency to include more traditional topics
- Fear of the unknown. Teachers want proof of success
- Difficulty of college placement. Teacher preparation, willingness to be flexible
- Sincerely believing our present approach (and results) better prepare our students for college
- Lack of receptiveness by state level education department personnel who guide the writing of course objectives
- Time preparation is greatly increased
- College acceptance of non-traditional course
- Many non-certified teachers teaching mathematics
- Resistance to any form of change by teachers (lack of interest)
- Lack of teacher training for integrated math programs
- Would have to be started in elementary school, especially for better students
- Unwillingness to change to a program that may not conform to mandated testing (CTBS, CAP, etc.) or college entrance requirements
- Harder to teach
- We found no real inhibitors - we had a positive transition from traditional to integrated
- The prestige that the calculus students have and want
- Would have to be done in regular state textbook adoption cycle
- Number of students who transfer between districts
- Teacher training colleges are eons away (behind) this concept. Profs need to be trained
- Time for inservice
- State and National testing programs. They are out dated and don't allow calculators

Question E2: Do you support Integrated Secondary Mathematics? Explain your choice.

•Offers greater flexibility

•We need to promote an understanding of mathematics in general and it can only be done by having students relate topics rather than study them separately

•I believe students today need a more holistic presentation of mathematics sue to their being more worldly and aware in the general sense of common knowledge due to their greater exposure of events.

•I support the use of real-world problems as a means of introducing and motivating students. When I see publishers writing books that actually do this and colleges actually providing help to teachers, I will be very excited. (And, why only secondary students?)

•Logical rather than historical validity. Works quite well for the rest of the world.

•For the students who do the work, it is easier. Easier to catch up after an absence. More kids take more math.

•Students retain and like math more. I'd never go back.

•A very high percentage of our students already take at last 3 years of math 9-12. 10% of the seniors successfully completed calculus during the first semester. We need to devote more effort to options for low ability students. Also, cost is a factor. I have yet to be convinced that an integrated program will be better for our students than the traditional program.

•It sounds like an excellent direction for the future, yet I'm not prepared for more at this time.

•I have always tried to get my students to "look at the overall picture." However, I feel there is a lack of good texts and it must be district-wide to be successful.

•Mathematics is naturally integrated. It should be taught that way.

•I believe we can get more math to more kids with an integrated program. Need texts at various levels without Canadian influence.

•I need more proof that it is better than non-integrated. (Proof from existing programs.)

•If sound workable texts are ready.

- It is important for students to learn that mathematics is NOT an assortment of segmented topics, but rather a unique system operating as a "whole", with many "tools" available for use in problem solving situations.
- Makes good sense, texts are improving in the area.
- Transferring students could be in an impossible situation. If this were state-wide (or nation-wide) I think it would be worth a try, but not a building-by-building adoption.
- If the school were large enough (more than one math teacher) it would be fine.
- I feel that with the current program, students forget too much of each individual topic while doing another and they don't see the connection between topics.
- Seems more in line with the NCTM recommendations.
- As I have seen it currently constituted, I don't see enough benefit to make the change.
- In theory, yes, but the reality of change is too overpowering. Staffing is the largest concern.
- The mathematics of life should be interwoven, no separation of disciplines.
- Our school district is investigating the possibility of adapting our curriculum to an integrated program. We anticipate this to be a two-year process.
- Still waiting for quality, truly integrated materials to use.
- When students are exposed to Algebra or Geometry for several years they retain it better. This has been true of several transfer students from the British system where I have had the privilege of teaching.
- Based only on my limited knowledge of what the "integrated secondary math program" is, I feel it has the potential to reach students and provide better understanding of how the pieces of the puzzle fit together. I feel it will be perceived by others as another "new math" however.
- I used such a program for 7th and 8th grade math and the results were not good. Topics were changed before students has a thorough understanding causing much repetition when the topic reappeared.
- Should promote retention.

- I have not see: 1) any data indicating this approach is better, 2) any textbooks which are really integrated, rather they just have more short classes instead of long ones
- It seems like a more natural way to teach and learn mathematics.
- I am not knowledgeable enough to have an opinion.
- They will better appreciate the relationship and overlapping in the various fields (subjects) of mathematics.
- The outcome of "integrated" is not superior to our traditional approach.
- Should provide more reinforcement, problems should arise in logical setting.

APPENDIX D

Montana and Washington State Department Chairs/Supervisors

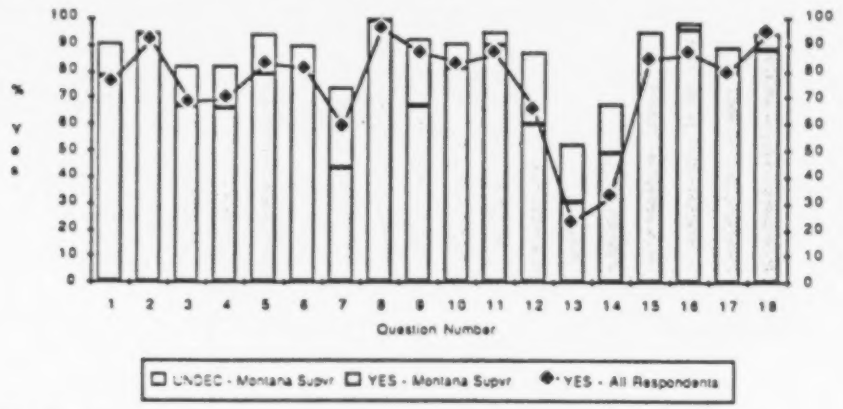
Survey Results

D-1 Montana State

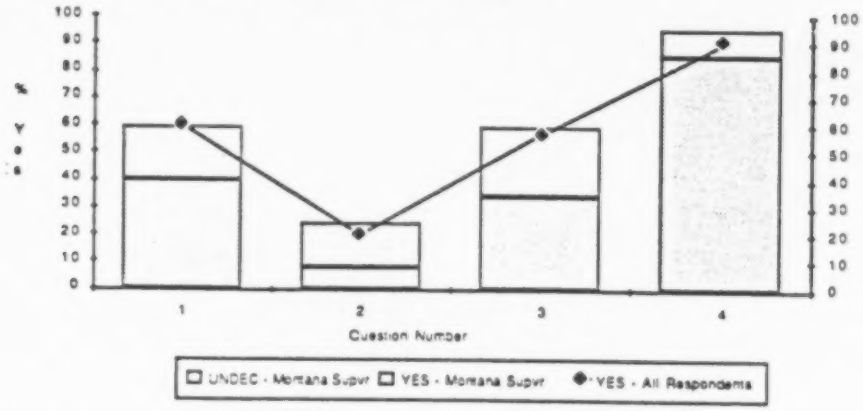
D-2 Washington State

Appendix D - 1
Montana State Supervisors
Responses by Item

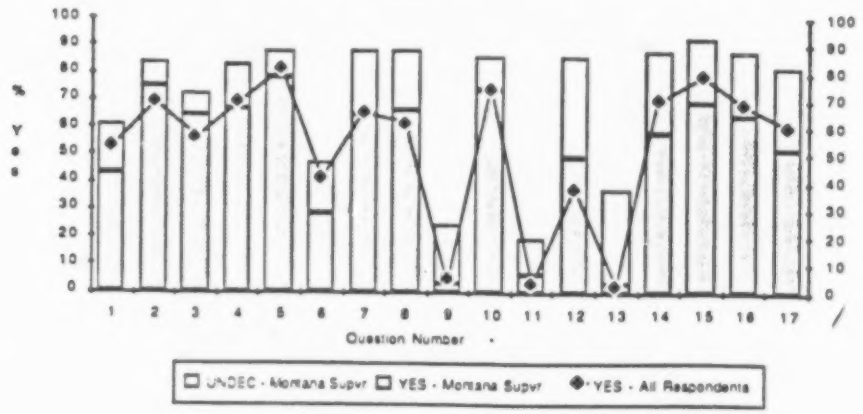
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

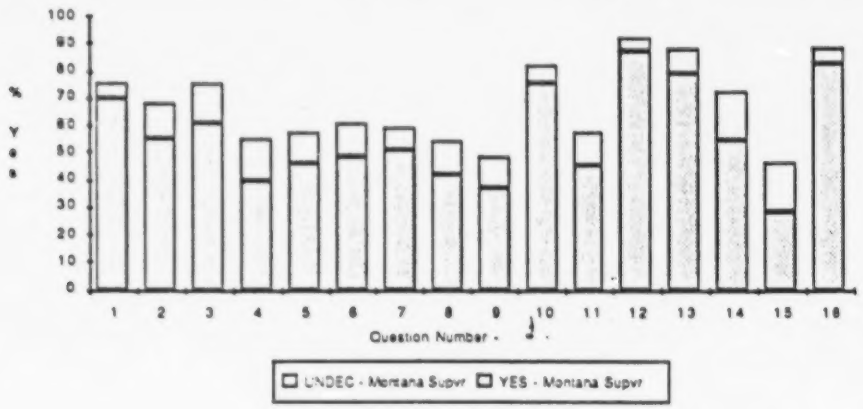


PART C: Outcomes of an Integrated Program



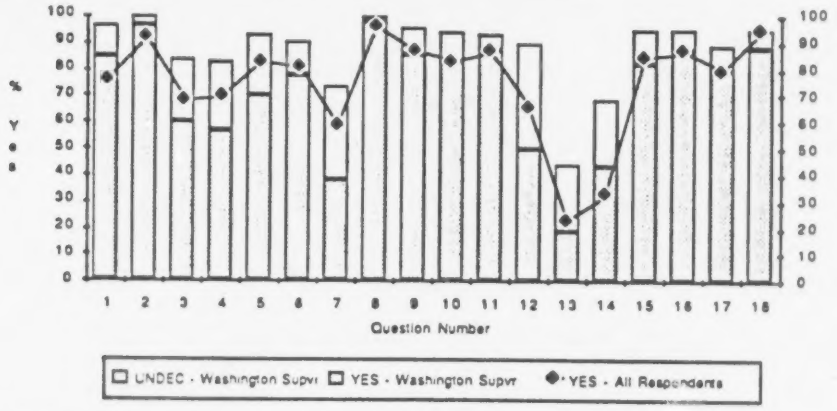
Appendix D - 1 (cont)
Montana State Supervisors
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics

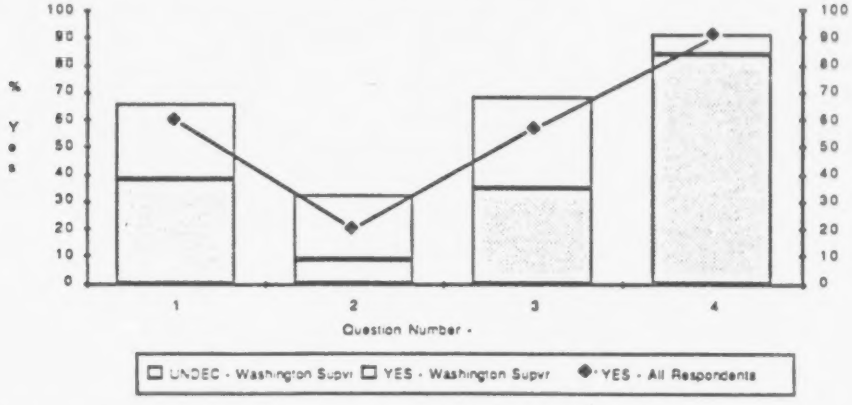


Appendix D - 2
Washington State Supervisors
Responses by Item

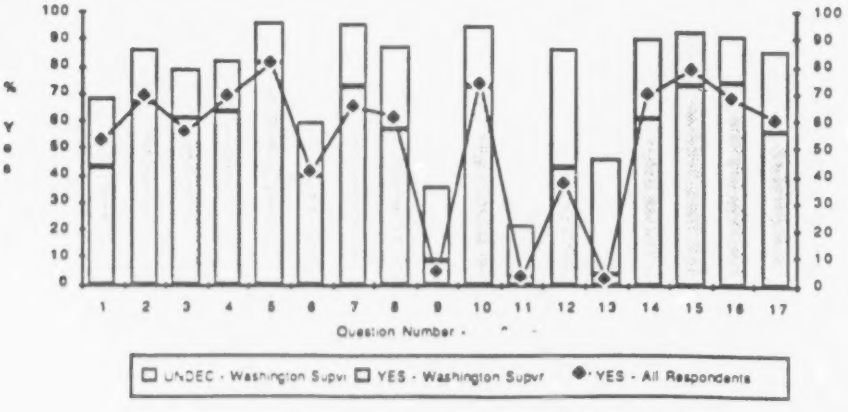
PART A: Components of Integrated Mathematics



PART B: Teachers in an Integrated Program

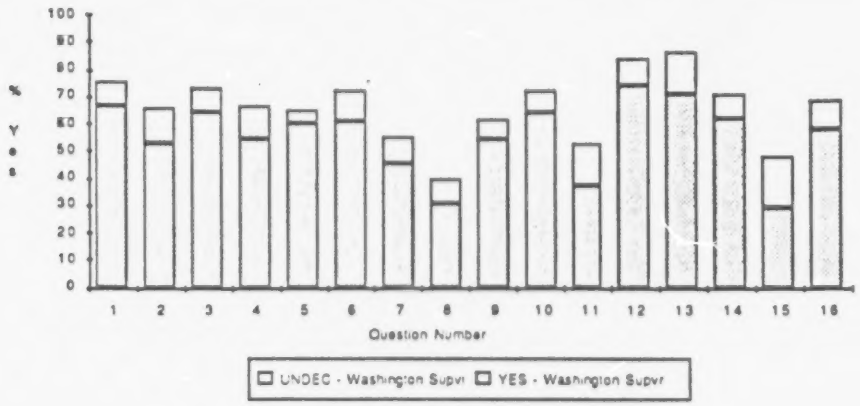


PART C: Outcomes of an Integrated Program



Appendix D - 2 (cont)
Washington State Supervisors
Responses by Item

PART D: Inhibitors to the Implementation of Integrated Mathematics



APPENDIX E

Packet for August Meeting

Integrated Mathematics Program Conference

August 25-27, 1989

Airport Ramada Inn

Spokane, Washington

The Montana Council of Teachers of Mathematics (MCTM) and the Washington State Mathematics Council (WSCM) are pleased that you will be a participant in the Integrated Mathematics Program Conference funded by the Exxon Foundation. The purpose of this conference is to develop a set of recommendations for implementing an integrated mathematics program for secondary schools in the United States. Please read the attached draft document reporting the results and implications, and come to the conference prepared to be react to the draft. As a result of the August conference, a final set of findings and policy statements regarding integrated mathematics will be completed and published.

The grant will provide for actual travel expenses not to exceed $250.00 (except in unusual cases to be cleared with Dan Dolan, Office of Public Instruction, 406/444-4436 by June 30, 1989). Please make plane reservations well in advance to take advantage of reduced fares. If you will be driving, the grant will pay $.25 per mile, but we ask you to carpool if possible. In addition, rooms (double occupancy) and meals will be provided including one meal on the return trip home.

The meeting will begin with lunch on Friday at 1:00 P. M. at the Ramada Inn and is scheduled to conclude by 12:00 noon on Sunday.

An agenda for the conference, a list of participants, and a Conference Response sheet is included. For further information, please call Johnny W. Lott at 406/728-2493 or Jack Beal at 206/543-1857.

Participants who plane to drive to the conference should follow signs to the Spokane International Airport. The Airport Ramada (brochure included) is directly across the street from the ariport. Participants arriving by plane may walk to the Inn or call for a courtesy car.

Enclosures

Draft Statement

Agenda

List of Participants

Response Sheet

Ramada Inn Brochure

INTEGRATED MATHEMATICS CONFERENCE

CONFERENCE INFORMATION FORM

AUGUST 25-27, 1989

AIRPORT RAMADA INN, SPOKANE, WASHINGTON

Name_____

Address_____
Street City State ZIP

Home Phone (_____)_____

School_____City_____

I would prefer a non-smoking_____ smoking _____ room.

If you have a preference for a roommate, please indicate.

_____

Please check one choice of dinner for each day.

FRIDAY Tenderloin tips in wine sauce_____

Breast of chicken in sherry sauce and mushrooms_____

SATURDAY Prime rib of beef_____

Scampi sauteed in wine and butter _____

PLEASE RETURN THIS FORM NO LATER THAN JULY 14, 1989.

MAIL TO : DAN DOLAN
MATH SPECIALIST
OFFICE OF PUBLIC INSTRUCTION
HELENA, MT 59620
406/444-4436

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Integrated Mathematics Conference

August 25-27, 1989

Airport Ramada Inn

Spokane, WA

AGENDA

FRIDAY

1:00- 2:30 Lunch

Welcome and Outline of Work to Be Done at Meeting--Dan Dolan, Montana Office of Public Instruction

2:30-3:30 Overview of Nationwide Survey--John Smith, University of Washington

3:30-3:45 Break

3:45-4:45 Preliminary Results of Survey--Jack Beal, University of Washington

4:45-5:45 Preliminary Recommendations Based on Survey Results--Johnny W. Lott, University of Montana

5:45-7:00 Break

7:00 Dinner

9:00- Informal Discussions

SATURDAY

7:30-8:30 Breakfast

8:30-10:00 Small Group Discussions on Characteristics and Definition of an "Integrated Mathematics Program." Groups led by Dolan, Smith, Beal, and Lott, with a Recorder chosen for each group

10:00-10:15 Break

10:15-12:00 Summary of Small Group Discussions; Recommendations for Refinement of Characteristics and Definition--Jack Beal

12:00-2:00 Lunch

2:00-2:30 Large Group Discussion of Outcomes--John Smith

2:30-4:30 Small Group Discussions on Implications led by Dolan, Smith, Beal, and Lott with a Recording Secretary chosen for each group

4:30-4:45 Break

4:45-6:00 Summary of Small Group Discussions; Recommendations for Refinement of Implications--Johnny W. Lott

7:00 Dinner

SUNDAY

7:30 Breakfast

8:30-9:15 Summary of All Refinements for Conference--Johnny W. Lott

9:15-11:30 Large Group Discussion of Possiblity of Future Grant Proposals--Dan Dolan

11:30-12:00 Evaluation of Conference--John Smith

12:00 Adjournment of Conference--Dan Dolan

DRAFT

JUNE 5, 1989

INTEGRATED MATHEMATICS PROGRAM

A POLICY STATEMENT

INTRODUCTION

The Integrated Mathematics Project was devised to examine the issue of whether or not mathematics should be taught in an integrated manner to all students at the secondary level to improve mathematics literacy in the general population. This is an issue of national importance as indicated in the 1987 Mathematical Sciences Education Board (MSEB) draft report entitled "A Framework for the Revision of the K-12 Mathematics Curriculum." The MSEB report states that "All years of both elementary and secondary school mathematics should be integrated in all grades in the sense that all the subject matter...should be interwoven and not considered as separate, unrelated topics." Further, it states "the mathematics studied should be fundamentally the same for all students."

In the 1989 Curriculum and Evaluation Standards for School Mathematics, the National Council of Teachers of Mathematics (NCTM) states, "One possible next step is for teachers and mathematics educators to develop curricula based on the standards. For example, the secondary school mathematics curriculum has typically been separated into courses with a specific subject orientation (e.g., algebra, geometry, statistics). This sequence provides teachers and students with a single-focus. We now challenge educators to integrate mathematics topics

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across courses so that students can view major mathematical ideas from more than one perspective and bring interrelated ideas to bear on new topics or problems."

As both the MSEB report and the NCTM Standards indicate, an interest in an integrated mathematics program for secondary schools is desirable.

In order to ascertain the extent of interest in and the implications of adopting such a program, a consortium of mathematics educators from Montana and Washington under the guidance of the Montana Council of Teachers of Mathematics (MCTM) with assistance from the Washington State Mathematics Council (WSMC) and the Departments of Education from Montana and Washington developed an in-depth national survey of the above stated policy.

The survey, conducted by Dan Dolan, Johnny W. Lott, Jack Beal, and John Smith, was supported by a grant from the Exxon Foundation. The questionnaire addressed the extent of the interest in, the curriculum structure and the content of, the pedagogical strategies critical to, and expected outcomes of, an integrated secondary mathematics program. The nationwide survey included all 50 state mathematics supervisors and a nationwide random sample of 500 state and district mathematics supervisors, 500 mathematics educators, and 500 secondary mathematics teachers. Survey forms are included in Appendix I. Results from 27 state supervisors, 150 district supervisors, 164 mathematics teacher educators, and from 140 mathematics teachers were compiled at the University of Washington and are summarized in Appendix II.

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SURVEY RESULTS

SUPPORT FOR AN INTEGRATED MATHEMATICS PROGRAM

There is very strong support, from all groups, for movement to an integrated secondary mathematics program to meet the needs of all students. State and district supervisors indicate that this movement will take place within the next five years.

DEFINITION OF AN INTEGRATED MATHEMATICS PROGRAM

The survey included the following working definition of an integrated mathematics program which was based on a search of literature.

> *An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete mathematics.*

Respondents were asked to answer all questions on the basis of the working definition. Upon analysis of the survey, the definition was modified as follows:

> An integrated secondary mathematics program is a holistic organization of topics provided in multiple learning contexts.

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CHARACTERISTICS OF AN INTEGRATED MATHEMATICS PROGRAM

CONTENT AND ORGANIZATION

1. An integrated mathematics program includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year-long studies of these subjects as discrete courses.
2. An integrated mathematics program includes probability and statistics.
3. An integrated mathematics program includes discrete mathematics.
4. An integrated mathematics program includes transformational geometry.
5. An integrated mathematics program provides continual reinforcement of ideas through a spiral arrangement of the curriculum.
6. An integrated mathematics program uses problems to organize content.
7. An integrated mathematics program must be adaptable to student readiness.

METHODS OF INSTRUCTION

1. An integrated mathematics program uses logic to facilitate the understanding of mathematics.
2. An integrated mathematics program allows for flexibility in determining length of time devoted to a topic.
3. An integrated mathematics program makes use of available technology.
4. An integrated mathematics program uses problems to organize instruction.
5. An integrated mathematics program requires problem involving more than one area of mathematics.

6. An integrated mathematics program includes the construction, validation, and evaluation of logical arguments.
7. An integrated mathematics course must be taught using different teaching methods than the traditional lecture method.

OUTCOMES

STUDENTS

1. Students from all ability levels will take more mathematics with the greatest increase among those of average ability.
2. All students will find mathematics interesting, will have a greater understanding of mathematics, and will have less loss of skills over time.
3. All students will be better prepared in mathematics with the greatest expectation for improvement in the noncollege-bound group.
4. Students may not necessarily find it easy to transfer between integrated mathematics programs and traditional programs.
5. An integrated mathematics program may have little effect on student achievement scores on current standardized tests.

TEACHERS

There will be greater communication among teachers using an integrated mathematics program.

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IMPLICATIONS

COLLEGES AND UNIVERSITIES

1. To accommodate more students with greater interest and depth of understanding in mathematics, colleges and universities need to develop alternatives to the present entry-level mathematics courses.
2. College entrance requirements should be modified to accommodate an integrated mathematics program.
3. Both preservice and graduate mathematics education programs must be redesigned to reflect an emphasis on a holistic view of mathematics and on a variety of instructional methods.
4. There is a need for research regarding problems experienced by students transferring between integrated and traditional mathematics programs.

SCHOOL SYSTEMS AND STATE DEPARTMENTS OF EDUCATION

1. More mathematics teachers will be needed to accomodate the greater number of students taking integrated mathematics courses.
2. State graduation requirements may have to be changed to accomodate an integrated mathematics program.
3. Appropriate inservice for mathematics teachers should be developed with an emphasis of pedagogy and a holistic view of mathematics.
4. Policy makers, administrators and teachers must become aware of the available state and federal funds for providing inservice training for mathematics teachers.

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5. All school related officials must become aware of national reform documents such as the MSEB Report to the Nation, the MSEB Curriculum Framework for Mathematics, and The NCTM Standards, all of which recommend implementation of an integrated secondary mathematics program.
6. All school related officials must be aware of the financial commitment necessary to implement an integrated mathematics curriculum in developing and purchasing curricular materials, re-educating teachers, and providing necessary inservice.

NATIONAL TESTING

An integrated mathematics program will demand a shift in emphasis in test construction to focus on new applications of skill and concepts characteristic of an integrated approach.

CURRICULUM DEVELOPERS AND PUBLISHERS

Appropriate curriculum materials for an integrated mathematics program must be developed to meet the needs of *all* students.

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Appendix I

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Integrated Mathematics Project Survey
Mathematics Teachers

Name of State_____ School Size_____ (number of students) District Size_____ (number of students)

School type: ☐ Urban ☐ Suburban ☐ Rural

Grade level: ☐ 7-12 ☐ 8-12 ☐ 9-12 ☐ other _____
☐ 7-9 ☐ 8-9 ☐ 10-12

Working Definition of Integrated Mathematics

An integrated mathematics program is a blended sequence of secondary mathematics topics organized in such a way that it includes the topics of first year algebra, geometry, and second year algebra/trigonometry, but eliminates the year long study of these subjects as discrete courses.

Part A: Using the working definition as a frame of reference, respond to the following statements on the basis of their being a necessary component of an *Integrated Secondary School Mathematics Program* rather than just a necessary part of a good secondary school mathematics program.

An integrated secondary school mathematics program must:	Yes	No	Undecided
1. Have a spiral arrangement of content	☐	☐	☐
2. Provide continual reinforcement of ideas	☐	☐	☐
3. Use problems to organize content	☐	☐	☐
4. Use problems to organize instruction	☐	☐	☐
5. Include statistics	☐	☐	☐
6. Use logic to facilitate the understanding of mathematics	☐	☐	☐
7. Include transformational geometry	☐	☐	☐
8. Require problem-solving involving more than one area of mathematics	☐	☐	☐
9. Promote a holistic view of mathematics	☐	☐	☐
10. Be adaptable to student readiness	☐	☐	☐
11. Allow for flexibility in determining length of time devoted to a topic	☐	☐	☐
12. Include discrete mathematics	☐	☐	☐
13. Promote formal proof in all of mathematics	☐	☐	☐
14. Have frequent changes in topics	☐	☐	☐
15. Include probability	☐	☐	☐
16. Make use of available technology	☐	☐	☐
17. Include the construction, validation, and evaluation of logical arguments by students	☐	☐	☐
18. Provide multiple contexts for students to learn mathematical concepts	☐	☐	☐
19. Other program components not listed: _____			

Supported by a grant from the Exxon Foundation to the Montana Council of Teachers of Mathematics in collaboration with the Washington State Mathematics Council

Part B: Teachers in an integrated secondary school mathematics program must:

		Yes	No	Undecided
1.	Use different teaching methods than those currently used	☐	☐	☐
2.	Have a different mathematics major than currently offered	☐	☐	☐
3.	Have a different preparation in pedagogy than currently offered	☐	☐	☐
4.	Be teachers of mathematics rather than algebra or geometry specialists	☐	☐	☐
5.	Other teacher characteristics not listed: _____			

_____

Part C: Using the working definition as a frame of reference, respond to the following statements on the basis of their being necessary *outcomes* of an *Integrated Secondary School Mathematics Program* rather than just a necessary outcome of a good secondary school mathematics program.

		Yes	No	Undecided
1.	Lower ability students will take more mathematics	☐	☐	☐
2.	Average ability students will take more mathematics	☐	☐	☐
3.	Higher ability students will take more mathematics	☐	☐	☐
4.	More students will complete 3 years of mathematics than now complete a first year algebra - geometry - second year algebra/trigonometry sequence	☐	☐	☐
5.	Regardless of when students quit taking mathematics, they will have a greater depth of understanding of mathematics	☐	☐	☐
6.	Students will have difficulty transferring from an integrated mathematics program to a traditional program	☐	☐	☐
7.	The loss of student mathematical skills will be minimized	☐	☐	☐
8.	College-bound students will be better prepared for college-level mathematics	☐	☐	☐
9.	College-bound students will be less prepared for college-level mathematics	☐	☐	☐
10.	Non-college bound students will be better prepared in mathematical life skills	☐	☐	☐
11.	Non-college bound students will be less prepared in mathematical life skills	☐	☐	☐
12.	Students will score higher on achievement tests in mathematics	☐	☐	☐
13.	Students will score lower on achievement tests in mathematics	☐	☐	☐
14.	Lower ability students will find integrated mathematics more interesting	☐	☐	☐
15.	Average ability students will find integrated mathematics more interesting	☐	☐	☐
16.	Higher ability students will find integrated mathematics more interesting	☐	☐	☐
17.	Communication about mathematics among teachers will be enhanced	☐	☐	☐
18.	Other outcomes not listed: _____			

_____

M.T.

Part D (cont): Which of the following might be *inhibitors* to the implementation of an integrated secondary mathematics program?

acher Educators:

		Yes	No	Undecided
1.	Lack of an awareness of such a program by policy makers	☐	☐	☐
2.	Lack of an interest in such a program by policy makers	☐	☐	☐
3.	Lack of an awareness of such a program by secondary mathematics teachers	☐	☐	☐
4.	Lack of an interest in such a program by secondary mathematics teachers	☐	☐	☐
5.	Lack of an awareness of such a program by college/university mathematics educators	☐	☐	☐
6.	Lack of an interest in such a program by college/university mathematics educators	☐	☐	☐
7.	Would require change in the preservice teacher preparation program	☐	☐	☐
8.	Background of present teaching staff in the state	☐	☐	☐
9.	Not useful in the foreseeable future	☐	☐	☐
10.	Lack of money to support necessary inservice	☐	☐	☐
11.	College entrance requirements at your institution	☐	☐	☐
12.	Lack of secondary mathematics curricular materials appropriate to meet the needs of ALL students	☐	☐	☐
13.	Not contained in present methods textbooks	☐	☐	☐
14.	Current integrated secondary mathematics curriculum materials do not meet the intent of an integrated program	☐	☐	☐
15.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
16.	Considered to be a "fad"	☐	☐	☐
17.	Current mathematics majors offered by institutions are not appropriate	☐	☐	☐
18.	Lack of supplementary materials	☐	☐	☐
19.	Amount of time needed for inservice is overwhelming even though money is available	☐	☐	☐

thematics Teacher:

		Yes	No	Undecided
1.	Lack of an awareness of such a program by school board members	☐	☐	☐
2.	Lack of an interest in such a program by school board members	☐	☐	☐
3.	Lack of an awareness of such a program by administrators	☐	☐	☐
4.	Lack of an interest in such a program by administrators	☐	☐	☐
5.	Lack of an awareness of such a program by teachers	☐	☐	☐
6.	Lack of an interest in such a program by teachers	☐	☐	☐
7.	Lack of good integrated mathematics textbooks	☐	☐	☐
8.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
9.	Threat to status quo	☐	☐	☐
10.	Cost of changing to a new program	☐	☐	☐
11	Other inhibitors: _____			

Mathematics Supervisors:

1. Lack of an awareness of such a program by policy makers .....
2. Lack of an interest in such a program by policy makers .....
3. Lack of an awareness of such a program by educators .....
4. Lack of an interst in such a program by educators .....
5. State mandated curriculum .....
6. State graduation requirements .....
7. Present preservice teacher preparation programs .....
8. Background of present teaching staff .....
9. Lack of money to support necessary inservice .....
10. College entrance requirements .....
11. Lack of integrated secondary mathematics curricular materials appropriate to meet the needs of ALL students .....
12. Current integrated secondary mathematics curriculum materials do not meet the intent of an integrated program .....
13. Difficulty of students transferring between integrated and traditional program
14. Logistics of inservice training of large numbers of teachers .....
15. Other inhibitors:

athematics Supervisors:

1.	Lack of an awareness of such a program by school boards	☐	☐	☐
2.	Lack of an interest in such a program by school boards	☐	☐	☐
3.	Lack of an awareness of such a program by administrators	☐	☐	☐
4.	Lack of interest in such a program by administrators	☐	☐	☐
5.	Lack of an awareness of such a program by teachers	☐	☐	☐
6.	Lack of an interest in such a program by teachers	☐	☐	☐
7.	District mandated curriculum	☐	☐	☐
8.	District graduation requirements	☐	☐	☐
9.	Background of present teaching staff	☐	☐	☐
10.	Lack of money to support necessary inservice	☐	☐	☐
11.	College entrance requirements	☐	☐	☐
12.	Lack of integrated secondary mathematics textbooks appropriate for ALL students	☐	☐	☐
13.	Lack of good integrated secondary mathematics textbooks	☐	☐	☐
14.	Difficulty of students transferring between integrated and traditional programs	☐	☐	☐
15.	Resistance from parents	☐	☐	☐
16.	Lack of money to support costs of new textbooks	☐	☐	☐
17.	Other inhibitors: _____			

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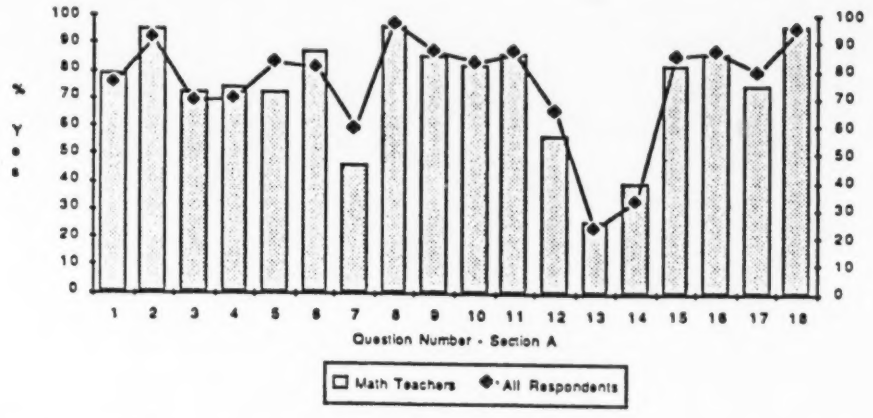
Appendix II

DO NOT QUOTE

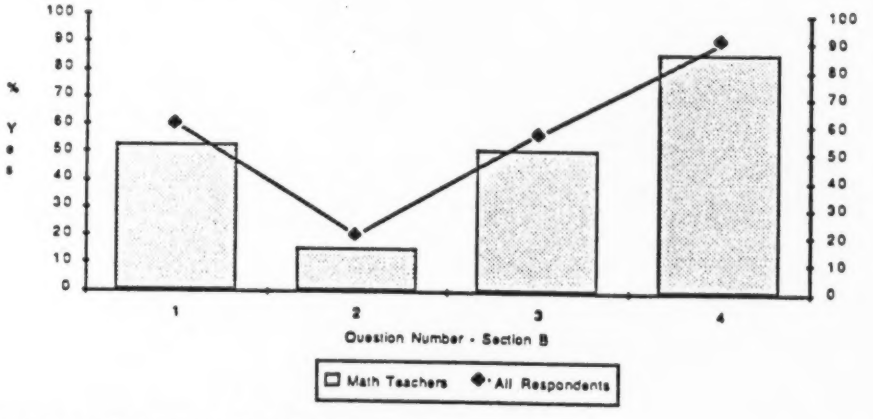
Integrated Mathematics Survey

MATHEMATICS TEACHERS

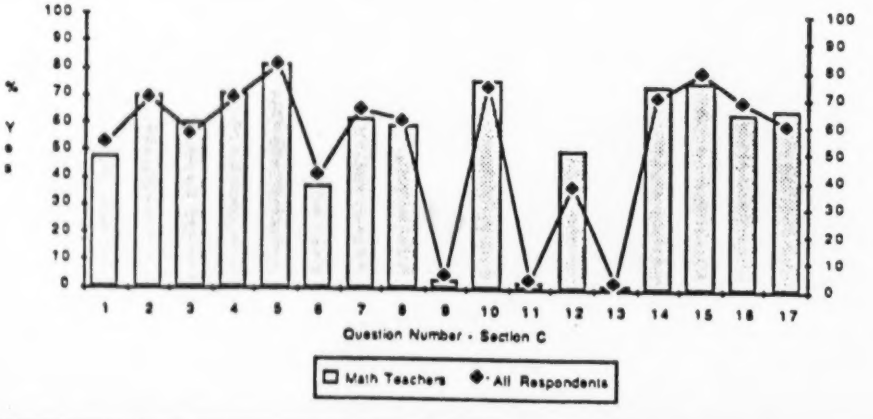
SECTION A: Components of Integrated Mathematics



SECTION B: Teachers in an Integrated Program



SECTION C: Outcomes of an Integrated Program



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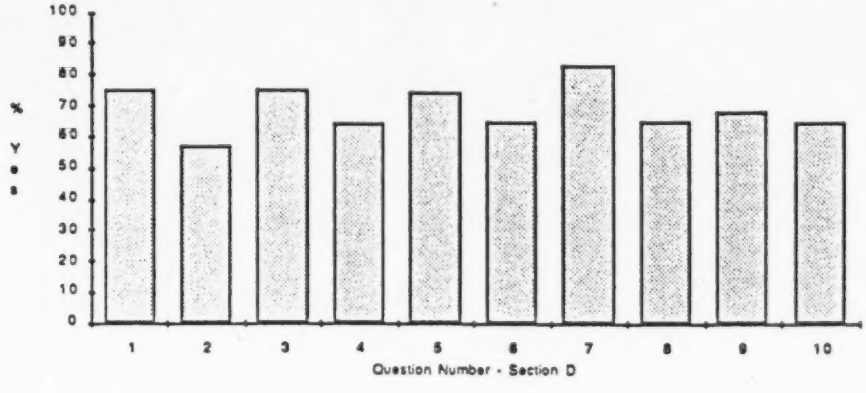
Integrated Mathematics Survey

MATHEMATICS TEACHERS

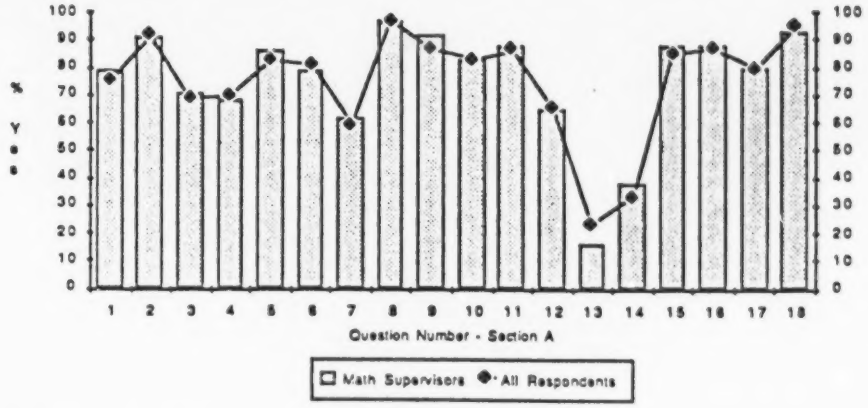
SECTION D: Inhibitors to the Implementation of Integrated Mathematics



Integrated Mathematics Survey

MATHEMATICS SUPERVISORS

SECTION A: Components of Integrated Mathematics



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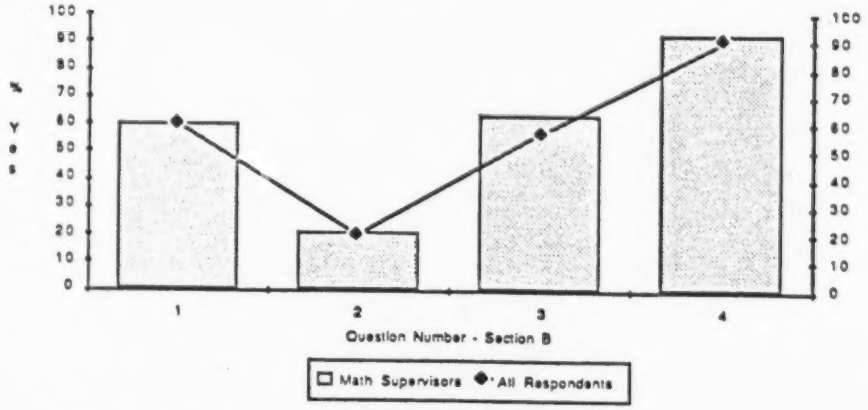
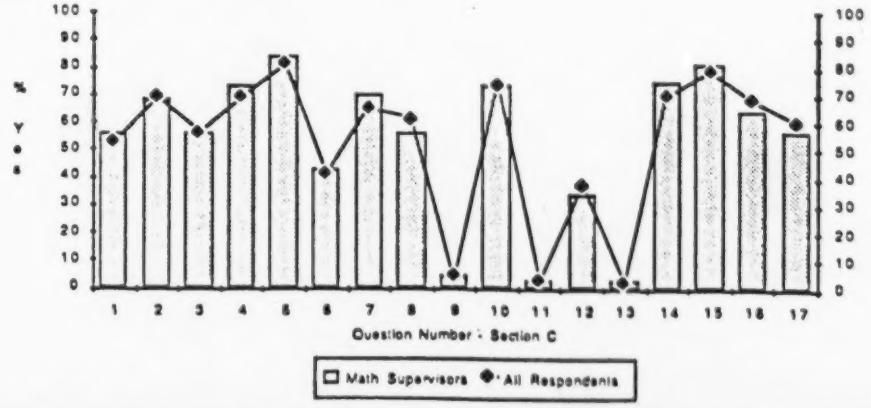


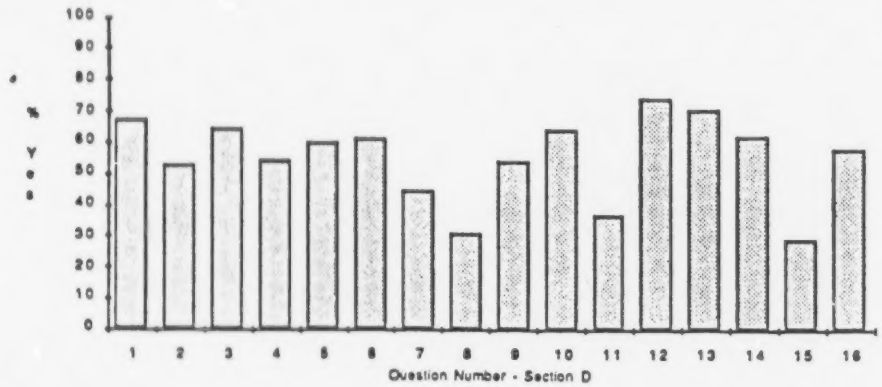
SECTION C: Outcomes of an Integrated Program



Integrated Mathematics Survey

MATHEMATICS SUPERVISORS

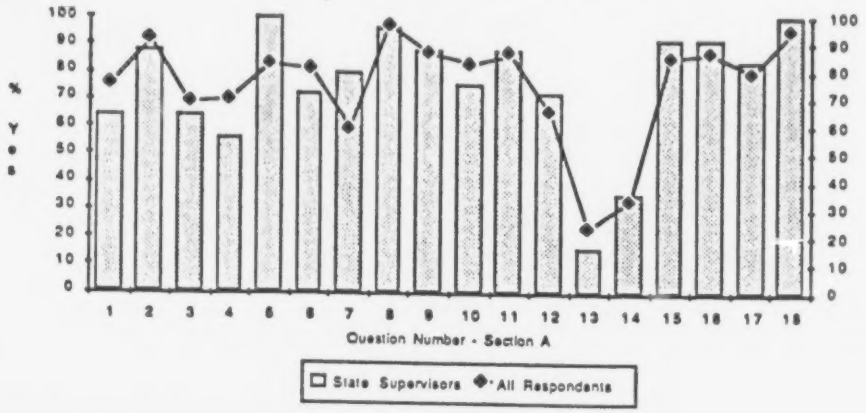
SECTION D: Inhibitors to the Implementation of Integrated Mathematics



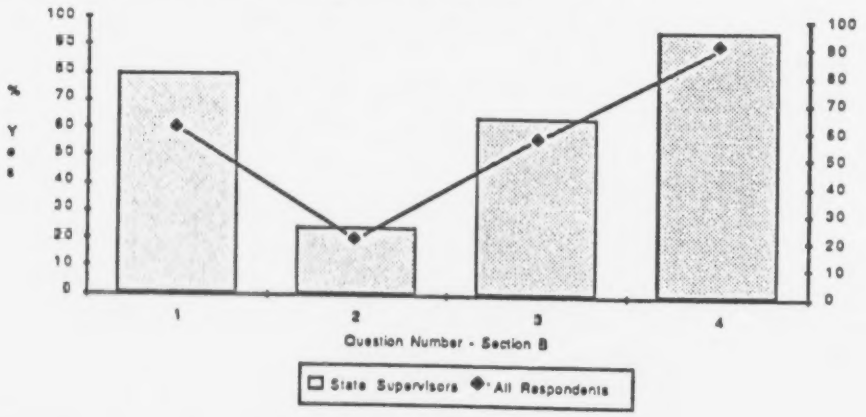
Integrated Mathematics Survey

STATE MATHEMATICS SUPERVISORS

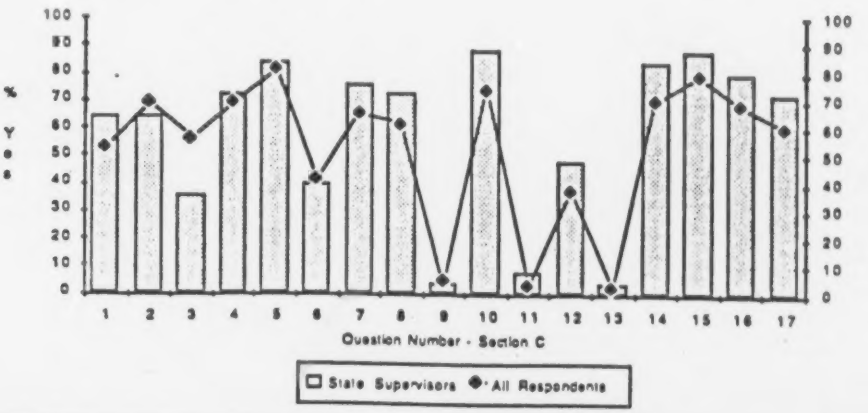
SECTION A: Components of Integrated Mathematics



SECTION B: Teachers in an Integrated Program



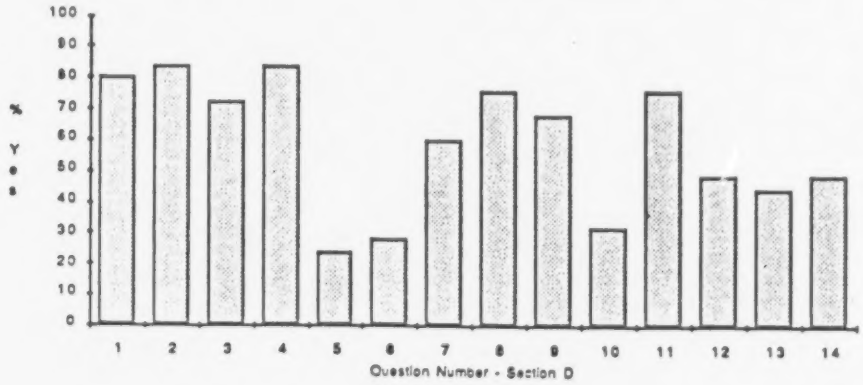
SECTION C: Outcomes of an Integrated Program



Integrated Mathematics Survey

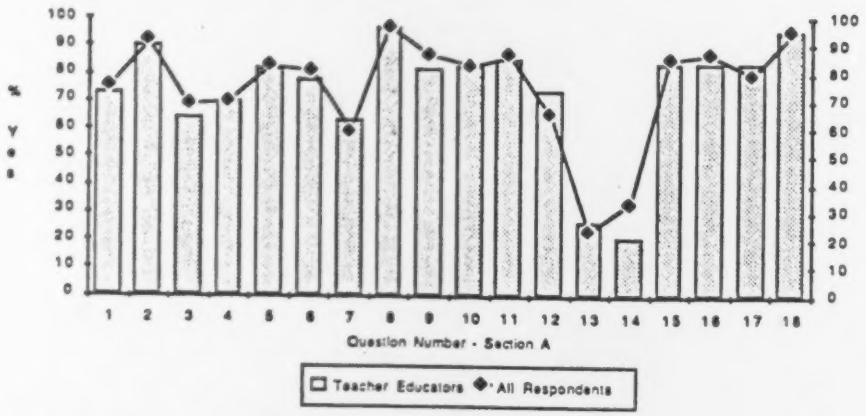
STATE MATHEMATICS SUPERVISORS

SECTION D: Inhibitors to the Implementation of Integrated Mathematics

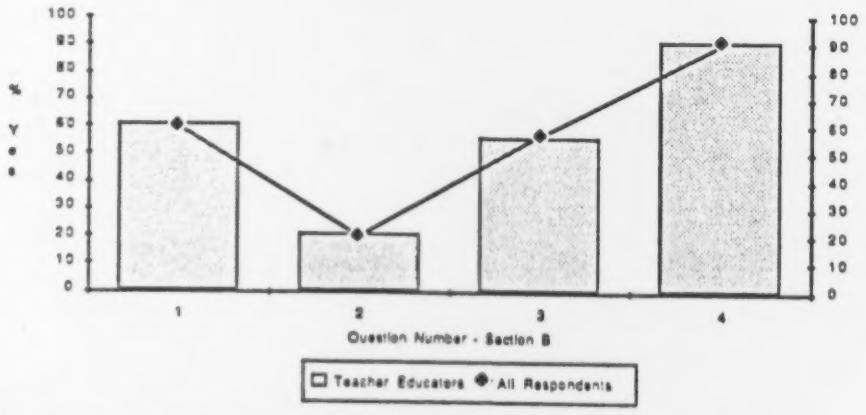


Integrated Mathematics Survey
TEACHER EDUCATORS

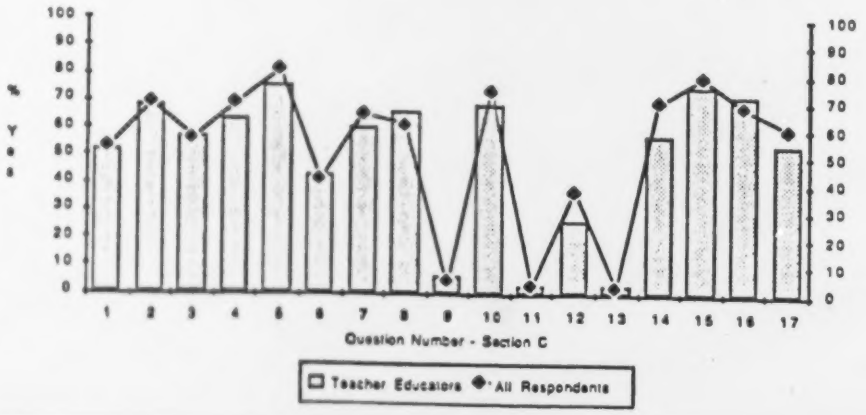
SECTION A: Components of Integrated Mathematics



SECTION B: Teachers in an Integrated Program

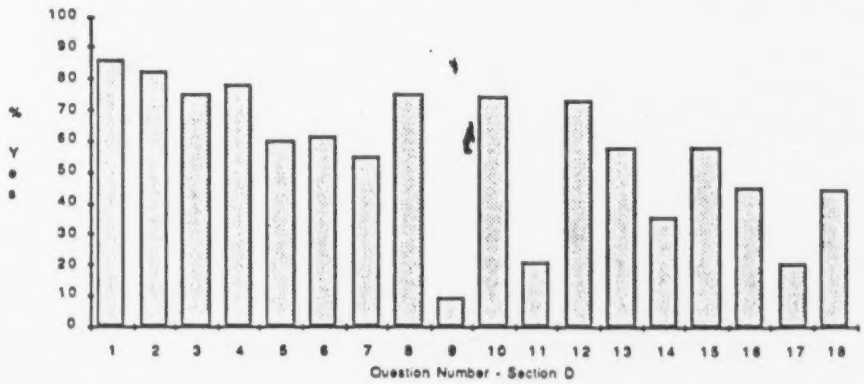


SECTION C: Outcomes of an Integrated Program



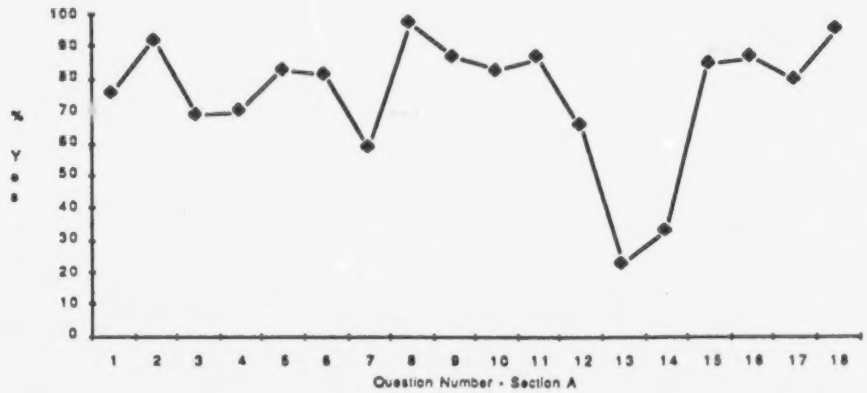
Integrated Mathematics Survey
TEACHER EDUCATORS

SECTION D: Inhibitors to the Implementation of Integrated Mathematics

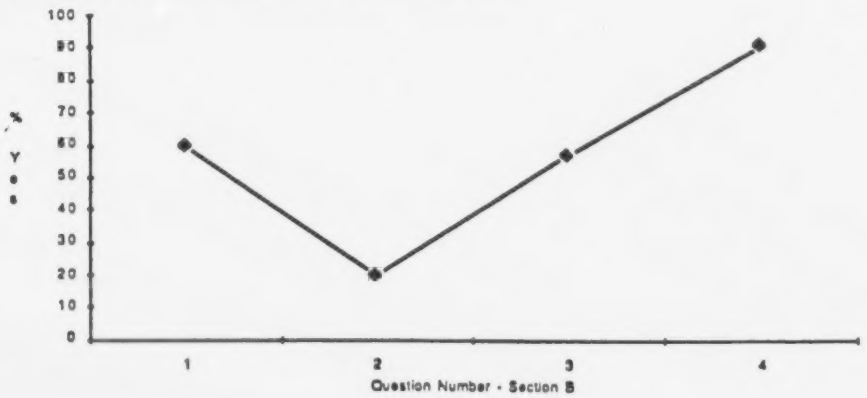


Integrated Mathematics Survey
ALL RESPONDENTS

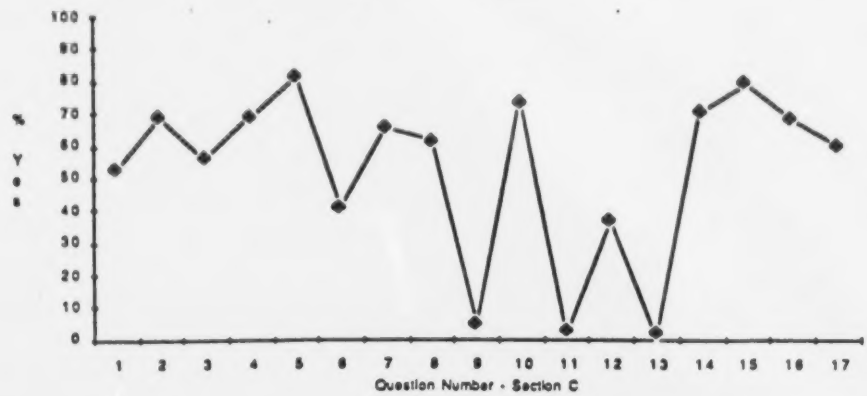
SECTION A: Components of Integrated Mathematics



SECTION B: Teachers in an Integrated Program



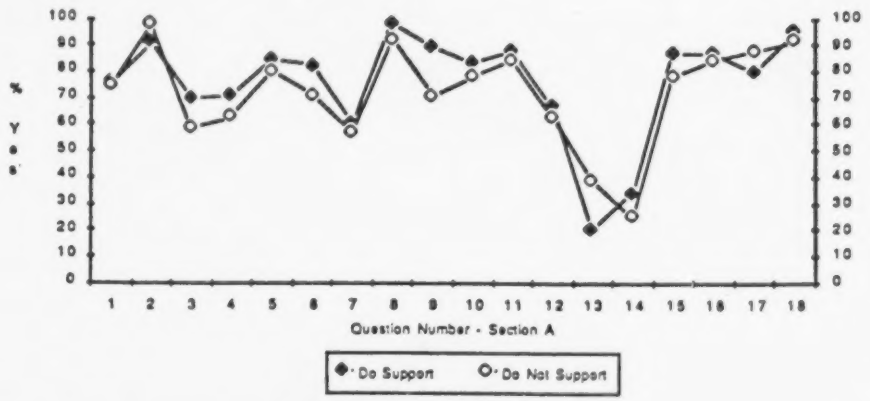
SECTION C: Outcomes of an Integrated Program



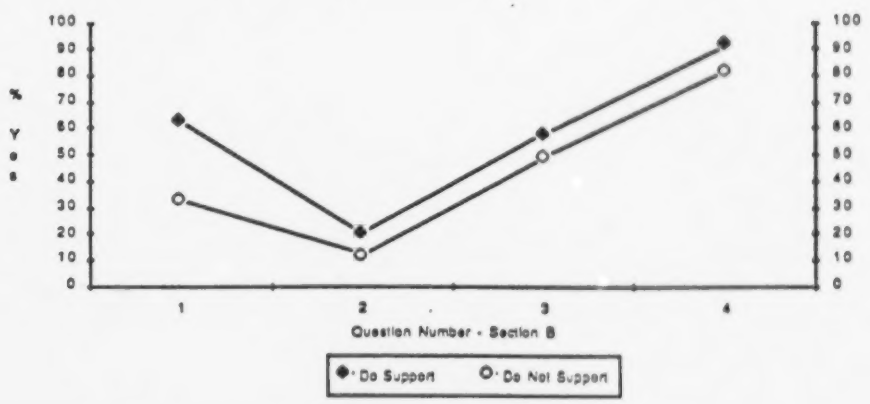
Integrated Mathematics Survey

COMPARISON: Support vs. Do Not Support

SECTION A: Components of Integrated Mathematics



SECTION B: Teachers in an Integrated Program



SECTION C: Outcomes of an Integrated Program